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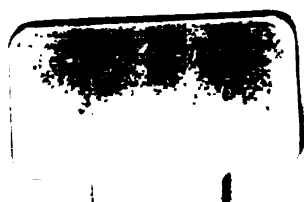
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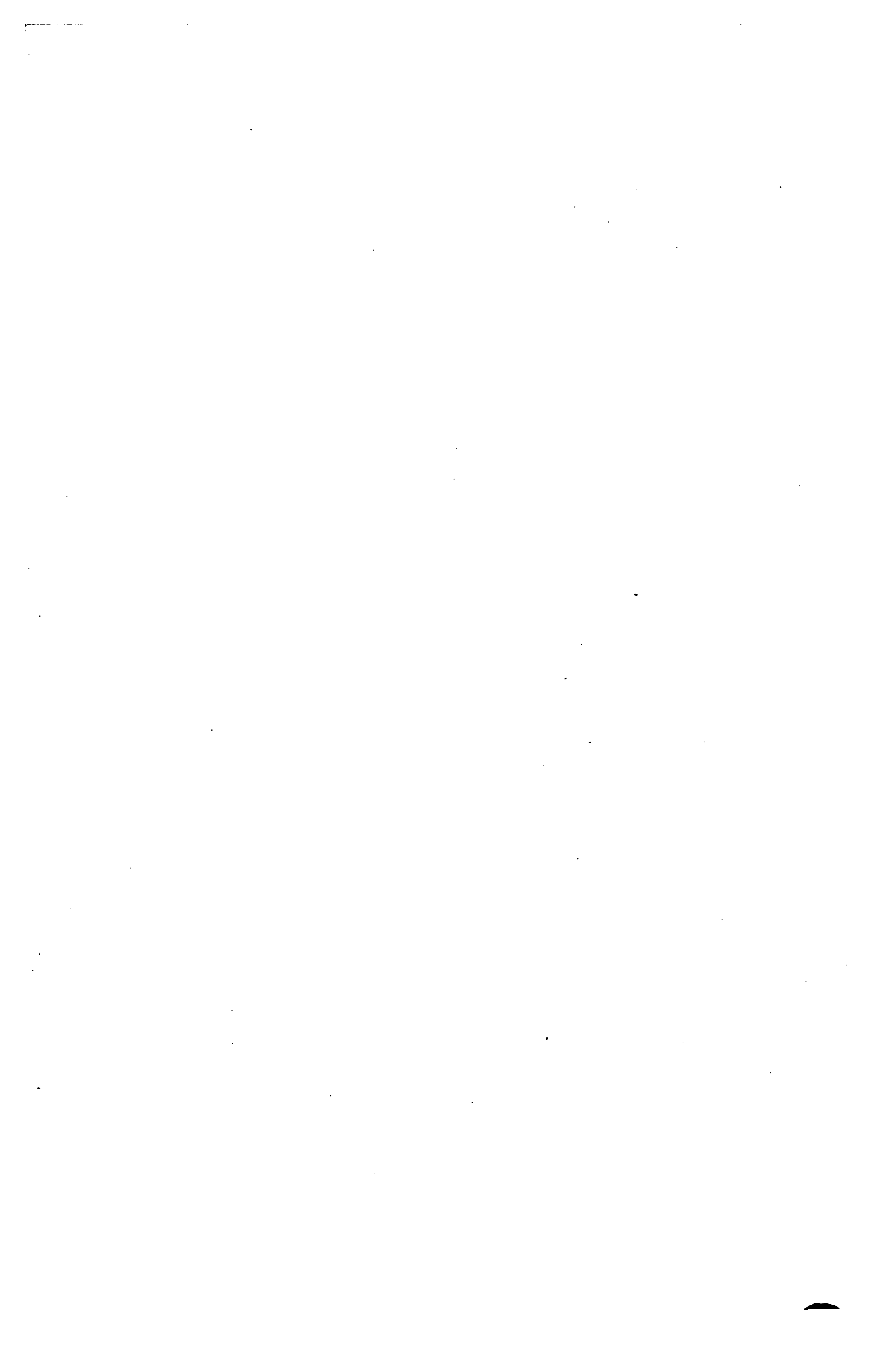
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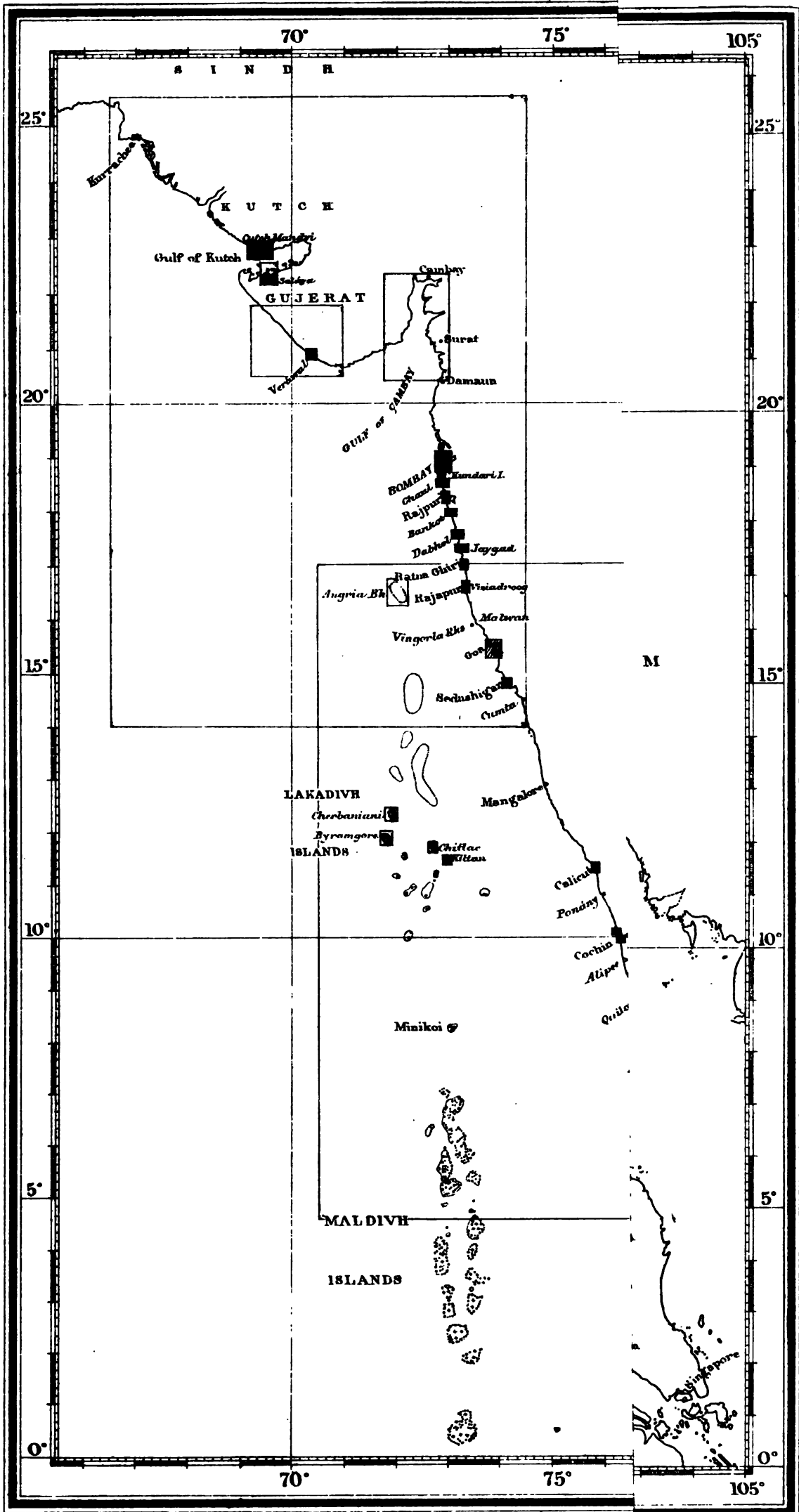
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Drawn by Rajjundar Naath Pasulit, under the direction of R.A. Carrington, F. R. A. S. Marine Survey Dept. GENERAL'S OFFICE, CALCUTTA.

GENERAL REPORT

ON THE OPERATIONS OF

The Marine Survey of India,

FOR THE YEAR

1880-81.

PREPARED FOR SUBMISSION TO THE GOVERNMENT OF INDIA

BY

COMMANDER A. DUNDAS TAYLOR (LATE I. N.), F.R.G.S.,
SUPERINTENDENT OF MARINE SURVEYS.



CALCUTTA :

OFFICE OF THE SUPERINTENDENT OF GOVERNMENT PRINTING.

1881.

CALCUTTA :

PRINTED BY THE SUPERINTENDENT OF GOVERNMENT PRINTING,
8, HASTINGS STREET.

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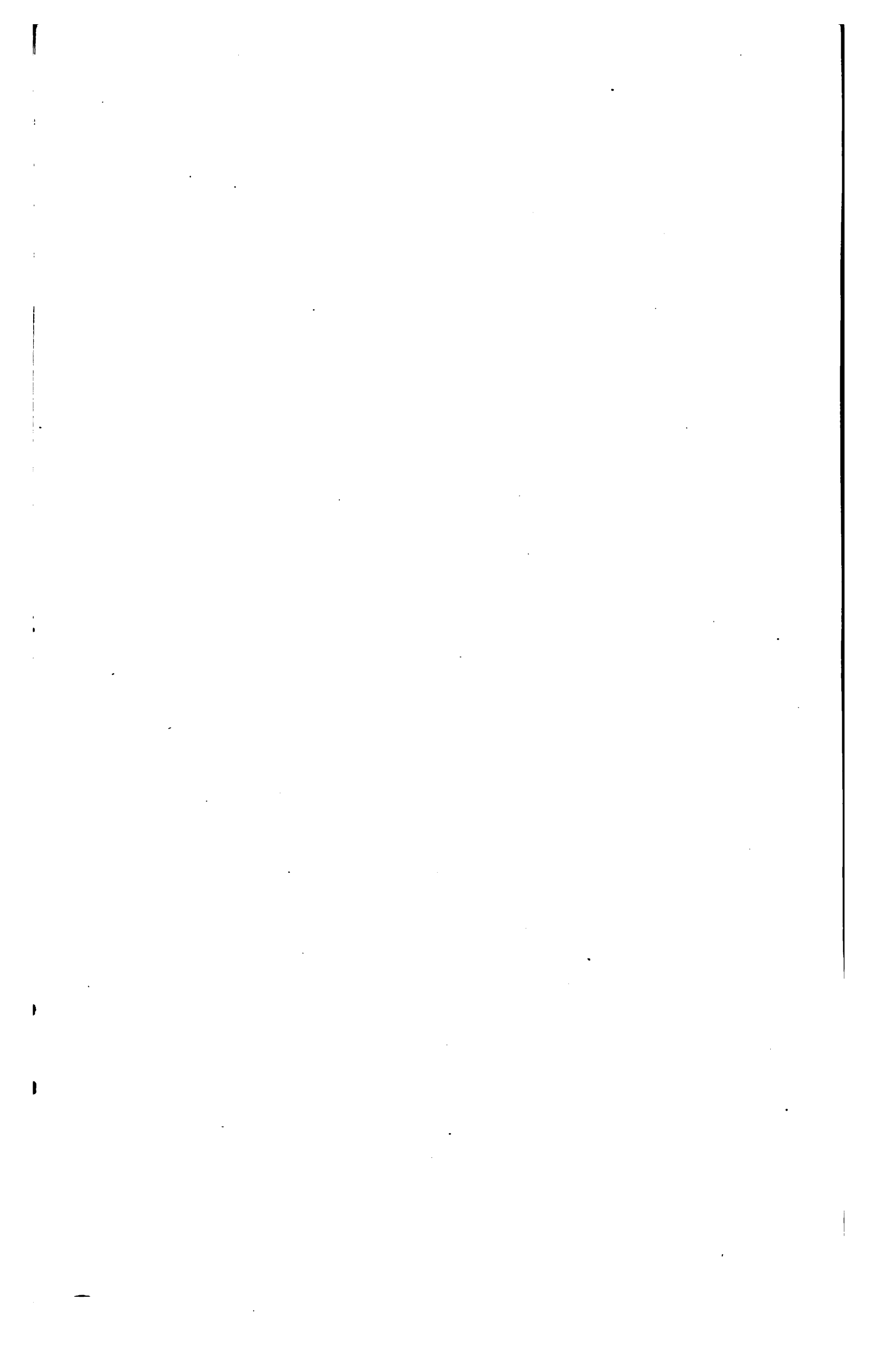
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GENERAL REPORT

ON THE OPERATIONS OF

The Marine Survey of India,

FOR THE SEASON

1880-81.

Dated Calcutta, the 1st December, 1881.

SECTION I.

GENERAL REPORT.

I have the honour to submit, for the information of the Government of India, my Annual Report of the proceedings of this Department during the surveying year commencing the 1st October, 1880, and ending 30th September, 1881, giving details of the surveys carried out by the Executive Staff of the Department, and the outturn of work at Head-quarters.

Surveying Operations of the Season.

Instructions to Officer in Charge of
No. 1 Survey Party.

2. The following are the instructions issued to
the Officer in Charge of the No. 1 Survey Party:—

This party, under the Superintendence of Navigating Lieutenant E. W. Petley, R.N., was—

- (a) To re-survey the northern approach of Prince's Dock, Bombay, provided that the Resident Engineer had completed his blasting operations in the bed of the channel.
Survey of Prince's Dock, Bombay.
- (b) To continue the survey of Goa and Mormugao harbours, commenced last season, by completing the engineering plans of Mormugao anchorage, on a scale of 600 feet to the inch, in order to show, in detail, the rocks and shoals extending from Cabo halfway across towards Mormugao. The chart of the entire neighbourhood of Goa and Mormugao was to be plotted on a scale of 3 inches to one nautic mile.
Survey of Goa and Mormugao.
- (c) To survey the foreshore of Bombay between the Prongs and Mazagon, carrying the soundings rather more than a mile seaward; this survey was to be executed on a scale of 5 inches=1 mile, and to continue the survey, to northward and eastward, to Hog Island and Caranja.
Survey of Bombay.

[NOTE.—How the above instructions were carried out will be seen by reference to Section III of this report, containing details of the surveying operations. Navigating Lieutenant Petley was unable to survey the approach channel into Prince's Dock in the early part of the working season, in consequence of the blasting operations then being conducted. But subsequently, in the latter part of May, the Port Trust Engineer having himself made a survey of the channel on a very large scale, Mr. Petley, at the request of the Port Trust, carefully tested the Engineer's work by sweeping the floor of the channel, and reported that the depth in the channel was nowhere less than 58 on the Town Hall datum (*i.e.*, 14 feet below the level of the mean of lowest ordinary spring tides, to which the soundings on the chart of Bombay have been referred). A detailed account of how this operation was carried out will be found on page 15.]

Instructions to Officer in Charge of
No. 2 Survey Party.

3. The instructions to No. 2 Survey Party were
as follows:—

This party, under Lieutenant W. H. Coombs, R.N., was—

- (a) To closely survey the Port of Rangoon, *i.e.*, from Kemendyne to Queen's Point, including the Poozoon-doung creek and part of the Pegu River, on a scale of 400 feet to one inch, the lines of sounding to be not less than 200 feet apart. The Port Trust of Rangoon was to supply a steam launch and other necessary materials for surveying operations, as also accommodation for the men.
- (b) On the completion of the Rangoon survey, Lieutenant Coombs, if time permitted, was to proceed with his party to the Naaf River (which is the boundary between Bengal and Burma) for the purpose of making a survey of the entrance on a scale of two inches to one nautic mile.
- (c) If the survey of the Naaf was not carried out, this party was to take up the re-survey of False Point harbour and the adjacent coast line, required by the Government of Bengal.

[NOTE.—Details of the surveys conducted by Lieutenant Coombs and his party will be found in Section III. The time occupied on the Rangoon survey was longer than originally contemplated, on account of the heavy fogs experienced until late in the day, and of the crowded state of the river by native craft in the busiest period of the year. Mr. Coombs was also employed on additional detached work in the examination of the shoal, which had recently contracted the channel in the neighbourhood of Elephant Point.

With reference to the Naaf River it may be stated that the Port Officer of Akyab having made a cursory examination of the entrance, and laid down buoys sufficient to indicate the channels for navigating small craft now using the river, it was deemed unnecessary for this Department to carry out the contemplated survey. Moreover the survey of Rangoon having occupied a much longer time than was at first expected, the season had too far advanced to make any rigid examination of the bar of the Naaf.

In lieu of the Naaf survey, commencement was made of a re-examination of False Point harbour, which involved accurate measurements of Reddie head previous to the rainy season, with a series of observations on the tidal current, during that season when they are influenced by the river freshets.]

New Surveying Steamer "Investigator".

4. The new surveying steamer *Investigator* was launched on the 3rd March, 1881, and, later on, orders were issued to prepare her with all despatch for the work of the approaching surveying season, and she is now nearly ready for sea.

I.G. Surveying Steamer *Investigator*.

5. On the application of the Government of India, the Admiralty nominated Lieutenant Llewellyn S. Dawson, R.N., to the post of Deputy Superintendent of Marine Surveys, and he will command the *Investigator*.

6. Lieutenant Dawson is an able surveyor of some 18 years' standing, and with his experience gained at the Hydrographic Department of the Admiralty, where he served for some five or six years under Sir Frederick Evans, K.C.B., F.R.S., will, I have no doubt, prove an invaluable officer to the Government of India.

Work executed at Head-quarters.

7. As usual, several questions have been forwarded to me by the Government of India, and the Local Governments and Administrations, to be reported upon; amongst these were the following:—

Subjects referred to the department
for report.

On the question of laying down and maintaining buoys in the Persian Gulf. Regarding the limits of the port of Chandbally.

On the proposal for connecting False Point light-house with Hukitollah by telephone.

On the present and proposed scales of establishment for the Perim light-house.

On the exemption of the Hooghly river from the operation of the rules regarding the new system of buoyage.

On a proposal for constructing a light-house at Muttum in the Travancore territory.

References from the Political Agent of the Governor General at the Baroda Durbar, regarding new lights at Dwarka, Beyt and Diu Head.

As to the advisability of blowing up Santipilly reef by dynamite.

8. In May, 1881, I was appointed President of a Committee, composed of Indian Naval Officers, to take into consideration the whole question of Light-house Administration in India.

Appointment of Light-house Committee.

The Committee were to consider the following points :—

- (a) The establishment, European and Native, necessary for each light.
- (b) The best means of relieving and supplying the same.
- (c) The arrangements necessary for an inspection, quarterly or annually, of each light.
- (d) Whether the system of relief, supply and inspection should be uniform as regards all the presidencies.
- (e) The advisability of arranging the lights in British Burma in four groups, and the simplest and most economical means of providing an efficient administration of those lights.
- (f) The levy of light dues to meet the cost of each light.

9. In the early part of July two members of the Committee proceeded on privilege leave for 3 months, and the proceedings of the Committee were therefore postponed until their return to Calcutta; since then the meetings have been resumed and the report is now in course of preparation.

10. Details of the work done in the Chart Branch of the department will be found in Section II. The usual letters, copies of reports, &c., have been prepared in the office, and, with the small staff at present employed, it has been only by the strictest economy of time, and diligence on the part of all employed, that arrears have not been allowed to accumulate.

Work at Head quarters office.

11. During the period under review one Hydrographic Notice and forty-one Notices to Mariners, relating to new lights, buoys, and newly-discovered dangers, have been published. The number of copies of Hydrographic Notices printed during the year amounted to 300, and of Notices to Mariners to 20,500; of these, 260 copies of the former Notices and 15,580 of the latter were forwarded to Indian maritime authorities and foreign Governments. The whole of the above Notices have been reproduced by the various Hydrographic Departments throughout the world.

12. The following table shows the Notices to Mariners and Hydrographic Notices issued between the 1st October, 1880, and the 30th September, 1881, inclusive :

Number of Notice.	Number of copies printed.	Localities to which Notices refer.	Subject.
1880.			
<i>Notices to Mariners.</i>			
11	500	Hindustan, West Coast, Bombay .	Regarding the exhibition of a red ray from the Kenery (Kundari) island light on and after the 1st April, 1881.
12	500	Eastern Archipelago, Sunda Strait, Sumatra.	Announcing the exhibition of a flashing light on Flat Cape.
13	500	Eastern Archipelago, Java, Sunda Strait.	Relative to the destruction of the stone light-house on First Point (Tanjong Koelong).
14	500	Eastern Archipelago, Baly Island .	Respecting the exhibition of a harbour light at Beliling (Papejan Beliling), near Sangsit.
15	500	China Sea, Carimata Strait . . .	Regarding the Gwalia reef.
16	500	Red Sea, Hanish islands . . .	Announcing the position of Parkin rock.
17	500	Indian Ocean, Mozambique Channel, Madagascar, West Coast.	Notifying the existence of a detached shoal lying south-west of Barren islands.
18	500	India, West Coast, Calicut . . .	Regarding the intended exhibition of a fourth order fixed white dioptric light at Calicut.

Number of Notices.	Number of copies printed.	Localities to which Notices refer.	Subject.
1880.		<i>Notices to Mariners—continued.</i>	
19	500	Red Sea, Gulf of Suez . . .	Relative to the lights and buoys at Port Ibrahim, Suez Bay.
20	500	Malay Peninsula, West Coast, Malacca Strait.	Regarding the exhibition of an intermittent flashing light on Pulo Undan or Outer Water island.
1881.			
1	500	India, Bay of Bengal, River Hooghly, Sandheads.	Respecting light regulations for Pilot brigs.
2	500	Bay of Bengal, Coromandel Coast, Madras.	Notifying the rules for regulating the entry and departure of vessels using the Madras Harbour.
3	500	Eastern Archipelago, Java, approach to Sunda Strait.	Announcing the re-exhibition of the flashing light on First Point (Tanjong Koelung).
4	500	Eastern Archipelago, Java, North Coast.	Regarding the exhibition of a light from the western mole head at Tegal (Tagal).
5	500	Bay of Bengal, British Burma, Ak-yab.	Stating that a basket beacon has been erected on Table-land, Borongo island.
6	500	Bay of Bengal, Coromandel Coast, Armeghon, Pulicat.	Respecting (1) the intended temporary discontinuance of the light at Armeghoa (Armogham), and (2) the intended change of the colour of the light at Pulicat.
7	500	Bay of Bengal, Chittagong Coast, Entrance to the Chittagong or Kornafuli river.	Notifying the erection of a tidal semaphore on Jooldea flagstaff hill, entrance to Chittagong or Kornafuli river, to denote the rise of the tide on the bar.
8	500	India, West Coast, Ratnagiri . . .	Regarding the alteration of the colour of the light at Ratnagiri.
9	500	Ceylon, West Coast, Colombo . . .	Relative to the red light on the Breakwater at Colombo.
10	500	Bay of Bengal, Godavery District, Coconada.	Respecting the red buoy off Point Gordeware (Godavery).
11	500	India, Madura and Malabar Districts.	Regarding slight alterations in the lights at Paumben and Tellicherry.
12	500	Eastern Archipelago, Java, approach to Sunda Strait.	Stating particulars of the permanent light on First Point (Tanjong Koelung).
13	500	Eastern Archipelago, Sumatra . . .	Regarding the alteration in the character of the light exhibited on Flat Cape (Vlakken hoek or Pamantyoos point).
14	500	Bay of Bengal, Coromandel Coast, Madras.	Notifying the removal of the north buoy at the entrance to the Madras Harbour.
15	500	India, Madura District, Paumben Pass, Gulf of Manar.	Regarding the range of visibility of the light at Paumben.
16	500	Hindustan, West Coast, Bombay . . .	Respecting leading Beacons for clearing the South-West Frong, Kolaba.
17	500	Africa, East Coast, Zanzibar Island	Relative to the light-houses on the coast of Zanzibar island.
18	500	Mediterranean, Suez Canal . . .	Regarding a buoy lighted by gas at the entrance to Port Said.
19	500	Bay of Bengal, Coromandel Coast, Armeghon (Armogham).	Announcing the exhibition of a revolving light at Armeghon (Armogham).
20	500	Hindustan, West Coast, Bombay Harbour.	Notifying that a beacon has been erected on Tucker's Patch, Bombay Harbour.
21	500	Bay of Bengal, Coromandel Coast, Pulicat.	Respecting the exhibition of a fixed white light at Pulicat.
22	500	India, West Coast, Ratnagiri . . .	Announcing the exhibition of a fixed white light at Ratnagiri.
23	500	Bay of Bengal, Coast of Orissa, False Point.	Regarding the occasional obscuration of the light at False Point by fog.
24	500	India, West Coast, Karwar or Sada-shivgad.	Stating that the buoy marking the Karwar rock (Gudsar sunv), has broken adrift.

Number of Notices.	Number of copies printed.	Localities to which Notices refer.	Subject.
1881		<i>Notices to Mariners—continued.</i>	
25	500	India, West Coast, Calicut . . .	Notifying the date of exhibition of the permanent white light at Calicut.
26	500	Bay of Bengal, Chittagong Coast, Kutubdea.	Respecting the alteration of the colour of the Kutubdea light-house.
27	500	India, Coromandel Coast, Pondicherry.	Regarding the exhibition of red and green lights at Pondicherry to mark the position of the pier and to facilitate anchorage at night.
28	500	Red Sea, Gulf of Suez	Announcing the erection of a new beacon on Kal-ah-Kebireh Shoal, Suez bay.
29	500	Ceylon, East Coast	Regarding a coral reef off Batticaloa.
30	500	Bay of Bengal, Coromandel Coast, Madras.	Notifying the revised rules for regulating the entry and departure of vessels using the Madras Harbour.
31	500	Bay of Bengal, Madras Coast . . .	Notifying that a green wreck-buoy has been laid to mark the position of the sunken vessel <i>Mariana</i> in Pentacottah roadstead.
		<i>Hydrographic Notices.</i>	
24	300	India, West Coast	Regarding the Harbours of Karwar and Bankot.

13. The list of lights and light-vessels in British India, including the Red Sea and Coast of Arabia, was prepared and issued; this list was corrected up to 1st January, 1881, from official information. The annual Return of Wrecks and Casualties in Indian waters was also published in due course. Both of the above publications were prepared by Mr. R. C. Carrington.

14. From the list of publications issued from this Department, and given in the Appendix, it will be seen that since April, 1875, the date on which work was commenced at head-quarters, till the 30th September, 1881, 68 new charts have been published, and 24 Hydrographic Notices, 172 Notices to Mariners, 5 Returns of Wrecks and Casualties in Indian waters (1876 to 1880), 6 editions of the List of Light-houses and Light-vessels in British India (1876 to 1881); and various other useful publications, including spheroidal tables, glossary of French terms, tables of natural scales, table of distances at which objects are seen at sea, &c., have been issued.

15. The following statement shows the number of charts received in, and issued from, the Office of the Marine Survey Department from 1st October, 1880, to 30th September, 1881:—

	No. of copies.	Value.			Remarks.
		Rs.	As.	P.	
RECEIPTS.					
Balance in stock on 1st October, 1880	13,876	16,736	15	0	
Receipts during the year from Secretary of State	654	946	14	0	
Receipts by purchase from Agent in England Do. from Surveyor General (for sale only)	3,010	3,830	0	0	
TOTAL	17,540	21,513	13	0	

	No. of copies.	Value.			Remarks.
		Rs.	As.	P.	
EXPENDITURE.					
Supplied for official use and to the Indian Government vessels	1,469	1,864	2	0	
Presented to Foreign and Local Governments, Hydrographic Departments, &c.	765	991	0	0	
Supplied on Commission sale	559	781	12	0	
Used in the Department	115	182	6	0	
Sold	1,757	2,284	2	0	
Cancelled	111	164	8	0	
Expenditure for the year	4,776 ^a	6,267	14	0	
Balance in stock on 1st October, 1881	12,764	15,245	15	0	
TOTAL	17,540	21,513	1 ³	0	

^a Of this number, 2,423 were copies of charts produced at the Marine Survey Department, and the remainder, 2,353, were Admiralty charts.

16. The following sales of charts, &c., were effected during the year :—

	Number of copies.	Rs.	As.	P.	Rs.	As.	P.
Indian Marine Survey charts,—							
Sold at office	923	=	1,021	0	3		
Sold by Agent	28	=	36	12	0		
Admiralty charts, sold at office	834	=	1,263	1	9		
	1,785					2,320	14 0
Books and other publications, such as Hydrographic Notices, Notices to Mariners, Light-lists, Tables, &c,—							
Sold at office			185	4	3		
Sold by Agent			217	9	0		
						402	13 3
Total amount realised by the sale of charts, and other publications, during the year from 1st October, 1880, to 30th September, 1881							
			Total Rs.			2,723	11 3

17. The steady increase in the sale of publications issued by this Department is a sufficient proof of the utility of such an office in Calcutta. In practical working it has been found necessary to sell charts direct from this office, as the clerk in charge of our publications at the Agent's office in Calcutta is, of course, unable to give any nautical information concerning passages, &c., or what charts are required for certain voyages. I have, therefore, inserted on all Notices to Mariners that Admiralty charts, in addition to our own publications, are to be obtained at this office.

Appointments, promotions, leave and good services of officers of the Department.

18. Lieutenant Llewellyn S. Dawson, R.N., was appointed on 7th September, 1881, by the Secretary of State for India, with the sanction of the Admiralty, to the post of Deputy Superintendent, 1st Grade, and reported his arrival in India on the 27th of the same month.

19. Mr. P. J. Falle, I.M., availed himself of privilege leave on 5th May, and returned to duty on 5th August, 1881. This officer was also compelled to take one month's sick leave from the 28th September, 1881.

20. Mr. W. H. W. Searle, I.M., was granted privilege leave from the 1st May to 1st August, 1881.

21. Lieutenant W. H. Coombs, R.N., and Navigating Lieutenant T. C. Pascoe, R.N., were promoted to be 1st Grade Assistant Superintendents, *sub. protem.*, from the 18th May, 1881.

22. Mr. W. H. W. Searle, I.M., was promoted to officiate, until further orders, as Assistant Superintendent, 2nd Grade, on the 13th September, 1881.

23. The services of Mr. F. W. Allen, 1st Grade officer of the Indian Marine, were placed at the disposal of this Department, and he was appointed Assistant Superintendent, 2nd Grade, on the 15th September, 1881.

24. The services of Messrs. H. B. Simpson, A. G. Mallock, and S. Warden, 2nd, 3rd, and 4th Grade officers, respectively, of the Indian Marine, were placed at my disposal for duty in the Marine Survey Department as a purely temporary arrangement on the 15th September, 1881: Messrs. Simpson and Mallock to officiate as Assistant Superintendents, 3rd Grade, and Mr. Warden as Executive Officer.

25. The services of Mr. H. A. Livermore, Licensed Leadsman of the Bengal Pilot Service, were temporarily placed at the disposal of the Government of India, for employment in the Marine Survey Department from the 27th September, 1881: Mr. Livermore to officiate as Executive Officer.

26. As I was informed in Government of India letter No. 5868, dated 27th June 1881, that "eulogistic notices of the services of officers and others in the performance of their current duties" were out of place in a report upon the operations of this Department, I reluctantly have to forego any allusion to the meritorious services of all engaged in this important work; but, as my services are to be dispensed with on the 1st July 1882, and this will consequently be my last annual report, I wish here to record my entire approval and appreciation of the energy and ability of all the officers now employed in the Marine Survey of India.

A. DUNDAS TAYLOB, *Commander (late I. N.),*
Superintendent, Marine Survey of India.

Staff of the Marine Survey of India.

27. On the 30th September, 1881, the strength of the Marine Survey Department was as follows:—

Superintendent of Marine Surveys Commander A Dundas Taylor, I.N., F.R.G.S.

Head-quarters Office.

Superintendent, Chart Branch	Robert C. Carrington, Esq., F.R.S.L., A.I.C.E.
Chief Clerk and Accountant	Mr. Donald Sunder.
Clerk	Babu Ishan Chunder Das.
Copyists	{ Babu Bidhoo Bhushun Dey.
	{ Babu Charu Chunder Basu.
Head Draftsman	Babu Kally Das Seal.
2nd Draftsman and Wreck Clerk	Mr. Thomas Ribeiro.
3rd "	Mr. Thomas Smith.
Apprentice Draftsman	Babu Pulin Behary Dutt.
" "	Babu Nogendro Nath Pal.
Chart Clerk	Mr. C. Thielmann.
Chart Mounter	Kally Das Dhur.

One duffary, one duffadar, four peons, and two menials.

Executive Staff,—Scientific Officers.

Lieutenant Llewellyn S. Dawson, R.N., F.R.G.S.	Deputy Superintendent, 1st Grade.
Navigating Lieutenant E. W. Petley, R.N., F.R.G.S.	Assistant Superintendent, 1st Grade, in charge of No. 1 Survey Party.
Lieutenant W. H. Coombs, R.N.	Assistant Superintendent, 1st Grade, in charge of No. 2 Survey Party.
Navigating Lieutenant T. C. Pascoe, R.N.	Assistant Superintendent, 1st Grade, attached to No. 1 Survey Party.
P. J. Falle, Esq.	Assistant Superintendent, 2nd Grade, attached to No. 2 Survey Party.
F. W. Allen, Esq.	Assistant Superintendent, 2nd Grade, attached to Surveying Steamer <i>Investigator</i> .
W. H. W. Searle, Esq.	Officiating Assistant Superintendent, 2nd Grade, attached to No. 1 Survey Party.
H. B. Simpson, Esq.	Officiating Assistant Superintendent, 3rd Grade, attached to Surveying Steamer <i>Investigator</i> .
A. G. Mallock, Esq.	Officiating Assistant Superintendent, 3rd Grade, attached to Surveying Steamer <i>Investigator</i> .
Vacant	Executive Officer.
S. Warden, Esq.	Officiating Executive Officer, attached to Surveying Steamer <i>Investigator</i> .
H. A. Livermore, Esq.	Officiating Executive Officer, attached to No. 2 Survey Party.

A. DUNDAS TAYLOR, Commander (late I. N.),
Superintendent, Marine Survey of India.

SECTION II.

CHART BRANCH.

This branch of the Department, under the superintendence of Mr. R. C. Carrington, has, as usual, been busily engaged in the production of several new charts, details of which are noted in the statement given below. The drawing of the several sheets issued has been good, sound work; the draftsmen, chart clerk and others employed are reported to have given every satisfaction.

During the year under review ten new charts have been published, from which 3,770 copies have been printed, by the photozincographic process, or have been engraved at the Office of the Surveyor General of India; 10,764 copies of Admiralty and Marine Survey Department charts were corrected by hand, for new, or alterations to, lights, buoys, beacons or recently discovered dangers to navigation; and upwards of 4,000 copies of charts were coloured. British, Foreign and Colonial Notices to Mariners and Hydrographic Notices have been examined and, where necessary, translated; they afford the data for the correction of charts stored in the Department. The various Hydrographical Offices and Marine Departments throughout the world have furnished this department with 1,028 such notices, England having contributed 284, America 165, Austria and Germany (*Kundmachung für Seefahrer* and *Hydrografische Nachricht*) 98, Holland (*Berigt aan Zeevarenden*) 76, France (*Annonce Hydrographique*) 155, Spain (*Aviso a los Navegantes*) 220, China 20, the Indian Government 41, and the Australian, New Zealand, and Dutch Netherlands Governments 69.

The following statement shows in detail the amount of work performed in this Branch from the 1st October, 1880, to the 30th September, 1881.

Number of chart.	Title.	Size.	Scale.	Remarks.
1252	Bankot and entrance to Savitri river.	D.E.	M=6'0	400 copies photozincographed. Prepared for publication from the original drawings, showing the results of the survey executed, in 1880, by Navigating Lieutenants E. W. Petley and T. C. Pascoe, Lieutenant W. H. Coombs, R.N., and Messrs. P. J. Falle and W. H. W. Searle, officers employed in the Marine Survey of India. Hitherto there has been no published chart of this port, and one was required for local purposes.
63	Sedashivgad Bay, including the Port of Karwar and Beikul Cova.	D.E.	M=3'0	400 copies photozincographed. This sheet shows the result of the survey by Navigating Lieutenants E. W. Petley and T. C. Pascoe; Lieutenant W. H. Coombs, R.N., and Messrs. P. J. Falle and W. H. W. Searle, in 1880. The chart has been compiled as follows:—the portions between Madulla point and Beikul bay, including the Oyster rocks, have been reduced from the surveys carried out by the officers of this Department; south of Beikul bay to Aurigi cape; the coast line and soundings, together with Anjidiva and Round islands, and the coast north of Madhulla point to Loliem point, with the soundings, have been taken from Commander Taylor's original surveys. A large scale (6 inches) plan of the port of Karwar has been given on the sheet. This chart supersedes the sheet published by the Hon. East India Company, and subsequently issued by the British Admiralty.

Number of chart.	Title.	Size.	Scale.	Remarks.
1257	Arabian Sea—Western portion	D.E.	D=1·0	500 copies photozincographed. These two sheets include the coasts of India westward of Madras, the island of Ceylon, the Gulf of Persia, a portion of the Red Sea, and Zanzibar. Large-scale plans of the following ports have been inserted in the spare spaces, <i>viz.</i> :—Bombay, Kurrachee, Colombo, Galle, Madras, Perim strait and Zanzibar. These sheets have been compiled from the latest charts issued by the Marine Survey Department and the British Admiralty. The names of ports on the Indian coasts have been inserted, and the authorized orthography has been followed. The want of a good chart of this portion of the Indian Ocean has been long felt.
1257 ^a	Ditto —Eastern portion	D.E.	D=1·0	500 Ditto ditto.
1256	Batticaloa Roadstead . . .	D.E. 4	M=6·0	300 copies photozincographed. This sheet shows the result of a survey by the officers of the Surveyor General's Department, Ceylon; the outer soundings have been adapted from the Admiralty plan of Batticaloa. Some newly discovered reefs have been reported, and this locality requires a careful examination; the present chart is issued as a "preliminary" one.
161	Stewart's Sound	D.E. 2	M=1·7	400 copies photozincographed. The chart has been produced for photozincography from the survey executed by Mr. D. Paget Jones, Commanding the Indian Government steamer <i>Kwangtung</i> in 1881. Entirely new work, no previous detailed examination of the coast and islands of Stewart's Sound having been made. It is a valuable addition to hydrography.
144	Port of Rangoon	8 D.E.	M=15.10 or 400ft. =1 inch.	100 of each photozincographed. These 8 sheets show the survey of the port, executed by Lieutenant W. H. Coombs, R. N., and Mr. P. J. Falle, Assistant Superintendents of the Marine Survey, 1881.
146	Port of Maulmain	D.E.	M=7·4	400 copies being photozincographed. The sheet is a reduction from the original survey made by Mr. Maurice Bean, of the Indian Marine, whilst officiating as Port Officer of Maulmain in 1879-80. The northern entrance of the Salween river being taken from the plan issued by the British Admiralty No. 1646; 8 Revenue Survey Maps have been reduced for the insertion of the topographical detail. The previously existing chart was extremely erroneous, having been issued some 40 years ago.
116	False Point to Muttiah River, showing the approaches to the Sandheads.	D.E.	M=0·3	300 copies photozincographed. The River Surveyor's new survey of the entrance to the Hooghly has been inserted on the chart, and other hydrographic corrections made in various parts of the sheets. This is the third edition of the chart; it is at present much in demand by the local pilots, and masters of vessels making the Sandheads.
	Suez to Penang, including Zanzibar and Madagascar.	D.E.	D=0·5	300 copies now being printed from the copperplate. This is a track and physical chart, to be also used for plotting the positions of the various wrecks and casualties which occur in Indian waters.
134	Coronge Island to White Point, including the Gulf of Martaban, from the latest Government Surveys.	D.E.	M.=0·20	250 copies photozincographed. The sheet was compiled in 1877; this is the second edition and embraces Commander Taylor's additions to the entrance to the Bassein River, and also soundings and other corrections received from Port Officers and Masters of Vessels. It is a useful general chart of the coast.

Number of chart.	Title.	Size.	Scale.	Remarks.
11	Magnetic chart of the Indian Ocean, showing the curves of equal magnetic variation for 1880.	D.E. 8	D. = 0·20	300 copies photozincographed. Compiled from the latest official documents, 1881. This sheet also shows, by means of tinted spaces, the approximate annual change of variation.
	Mormugao and Goa Roadsteads	D.E.	M. = 2·60	<i>In progress.</i> Shows the results of the surveys in 1881, by Navigating Lieutenants E. W. Petley, and T. C. Pascoe, R.N, and Mr. W. H. W. Searle, Officers employed in the Marine Survey of India.
	Index map of India for 1880	D.E. 8	D. = 0·50	310 copies photozincographed. To accompany the General Report. Showing the surveys completed by the Officers of the Marine Survey Department, and sheets published from the results of these surveys, and those compiled from various authorities.
	Index chart of Light-houses and Light-vessels in British India for 1881.	D.E. 8	D. = 0·25	310 copies photozincographed. Bound up with the sixth edition of the "Light-houses of India."
	Cape Comorin to Point Calimere, including the Island of Ceylon, with plans.	D.E.	M. = 0·10	<i>In progress.</i> It is intended that the sheet shall embrace the whole of the Island of Ceylon. A good general chart of the island, with the adjacent coast is much needed.— Large-scale plans of Galle, Colombo, Trincomali, &c., will be inserted on the spare spaces of the sheet.
	Gulf of Cambay	D.E.	M. = 0·50	<i>In progress.</i> The present chart of the gulf is a most erroneous one, not only in the hydrographic details, but the coast is greatly in error, and has never been adapted to the positions determined by the Great Trigonometrical Survey. Elaborate surveys within the coast line have been made, and the results published at the Surveyor General's Office, and these will be utilised in this compilation; the hydrographic portion to be inserted, from time to time, as it reaches this office.

Miscellaneous.	For what purpose executed.
Six copies of portion of the Gulf of Cutch, showing Commander Taylor's amendment of Sainia light.	For the Government of India, Messrs. Chance Brothers, and also for office use.
Portion of Revenue Survey Map of Cutch Coast, including Cutch Māndvi.	Tracings for transmission to the Hydrographer to the Admiralty, and also for correction of charts.
Three copies of charts showing work performed by the department during the past five years.	For submission to the Government, and also for office use.
Four tracings of portion of Lieutenant Hammond's sheet of Cocanada, showing Commander Taylor's additions.	For transmission to the Hydrographer to the Admiralty, and also for office use.
Nine copies of Commander Taylor's new proposal for lighting the Sandheads.	For the use of the Committee enquiring into the lighting of the River Hooghly, and also to accompany Commander Taylor's report.
Three copies of corrections to the buoys and beacons in Mergui harbour, by the Commissioner of Mergui.	For office use, and for correction of charts.
Additions to the original drawing of Orissa Coast, No. 1172, by Commander Taylor.	For photozincography, and also for correction of charts.
Additions to the original drawing of Orissa coast, No. 1172, by Captain Murray of the P. and O. Steamer <i>Nepaul</i> .	Ditto ditto.
Additions to the original drawing of Sandheads, Chart No. 116, by the River Surveyor.	Ditto ditto.

Miscellaneous.	For what purpose executed.
Commander Taylor's corrections and additions to the Admiralty sheet of Cochin No. 65, and Madras Government Lithographic sheet of Cochin by Mr. Sweeny.	For comparison, and also for office use.
Ditto ditto.	To accompany report.
Tracing of corrections to Kurrachee harbour by the Port Engineer.	For office use, and also for additions to the plan of the harbour on the sheet of the Arabian sea.
Tracing of portion of Kurrachee harbour near Manora point, by Mr. Wray.	To accompany Commander Taylor's report.
Reduction of Kurrachee harbour sheets, by the Harbour Works Engineer.	For compilation of the plan of the harbour on the sheet of the Arabian sea.
Reduction of Admiralty plan of Batticaloa	For new sheet of Batticaloa.
Ditto Batticaloa Roadstead, by Surveyor General, Ceylon.	For photozincography.
Copy of sketch of Kundari island, with soundings, showing position of grounding of the I. G. Steamer <i>May Frere</i> .	For office reference.
Copy of view of Sandoway by Commander Taylor . . .	For British India Steam Navigation Company.
Copy of Commander Taylor's additions and corrections to Sandoway.	For transmission to the Hydrographer to the Admiralty and for correction of charts.
Reduction of Naaf river by Port Officer, Arracan . . .	For office record, and also for comparison with Weston's Survey.
Reduction of diagram of Chittagong tidal semaphore . .	For office use and for publication.
Topographical details (from 8 sheets of the Revenue Survey map of Rangoon) for the original of the Port of Rangoon by Lieutenant Coombs.	For completion of the original drawing showing the Survey of Port.
Two copies of tracing showing surveys completed in Bombay harbour by Lieutenant Petley.	For Government of India, and for office use.
Copy of portion of sheet of Karwar showing Beitkul Cove, by Lieutenant Petley.	For Executive Engineer, Canara.
Copies of specimens of Birmingham port or signal lights	For office record.
Additions to False Point harbour by Commander Taylor	Ditto , correction of charts, and also to accompany report.
Ditto Ditto	For Port Officer, False Point.
Tracing of Stewart's sound, Andamans, from the original drawing by Mr. D. Paget Jones, I. G. Steamer <i>Kwangtung</i> .	For office use.
Reduction of River Surveyor's sheet of the entrance to the Hooghly.	For additions to the Sandheads chart.
Three copies of sheet No. 1165 showing corrections at False Point harbour by the Port Officer.	For Government of Bengal, and also to accompany report.
Reductions of charts Nos. 164, 253a and b, 6a and b, 100a and b, 8b, c, d and e, 2592, 598, 670, 1811, 667, 664, 640a and b, 665, 674, 597, 721, 748b, 2483, 10a, b and c, 2837a and b, 753, 38, 826, 827, 828, 829, 70, 2737, 2736, 40, 2621, 2738, 66a, b and c, 3, 1171, 1175, 737, 105, 71b and c, and 103a.	Used in the compilation of sheets of the Arabian sea.
Copy of view of Friar's Hood, Ceylon, by Commander Taylor.	For transmission to the Hydrographer to the Admiralty,
Tracing of Diligent Strait, Andamans, by Mr. D. Paget Jones, I. G. Steamer <i>Kwangtung</i> .	Ditto ditto.
Three copies of scales for plotting Port Rangoon work .	For Mr. Falle.
Reduction of Preparis sheet No. 137	For additions to the original of Gulf of Martaban.
Reduction of sheets 242, 744, and Commander Taylor's original Nos. 155 and 157.	For compilation of Port of Karwar sheet.
Copy of portion of Rangoon river near Elephant Point by Lieutenant Coombs.	For Government of India.

Miscellaneous.	For what purpose executed.
Tracing of portion of Rangoon river near Elephant Point by Captain Campbell, I. G. Steamer <i>Enterprise</i> .	For office record.
Copy of portion of Bombay harbour by Lieutenant Petley showing the surveys executed.	For Government of Bombay.
Two copies of a survey of portion of Andamans, including Interview and Landfall islands by Mr. D. Paget Jones, I. G. Steamer <i>Kwangtung</i> .	For transmission to the Hydrographer, and also for office use.
Copy of sheet No. 113 showing Commander Taylor's additions and corrections to Cocanada Bay.	For No. 2 Survey Party.
Copy of correct positions of buoys, &c., at False Point harbour.	For office use, and for correction of charts.
Corrections to the Index map of India for 1880 . . .	For the General Report for 1879-80.
Wreck chart showing the wrecks and casualties that occurred on the coasts of India and Burma during 1880.	For binding up with the Wreck Report.
Corrections to Madras sheet showing the Harbour Works extension.	For correction of charts, and also for office use.
Obtaining means of meteorological observations for 1880 recorded at various ports in India.	For the Wreck Return.

SECTION III.

SURVEYING OPERATIONS, SEASON 1880-81.

WEST COAST OF INDIA.

In accordance with the programme of work, submitted by me in July 1880, and sanctioned by the Government of India, the following operations were carried out between 1st October 1880, and the 30th September 1881 :—

BOMBAY.

No. 1 Survey party, which consisted of three officers, two native surveyors

Navigating Lieutenant E. W. Petley,
R.N., Assistant Superintendent, 1st
grade, in charge.

Navigating Lieutenant, T. C. Pascoe,
R.N., Assistant Superintendent, 2nd
grade.

W. H. W. Searle, Esq., Assistant
Superintendent, 3rd grade.

Mr. B Rajaram, native surveyor.

Mr. H. C. Govind, native surveyor.

(as marginally noted), an engineer and apothecary, a clerk, two tide-watchers, twelve lascars and fireman, together with two steam-cutters and a whale-boat, was formed in Bombay on the 1st October 1880.

Lieutenant Petley placed himself in communication with the port trustees, port officer, resident engineer and commandant of artillery, and obtained the necessary permission to erect flags and make stations wherever suitable for the work, while Lieutenant Pascoe, with the assistance of Mr. Searle, prepared the office, re-engaged the establishment to its full strength, drew stores, &c., and generally arranged the billeting of the party.

The work was commenced on the 11th October and completed on the 22nd November 1880; it consisted of a careful survey of the foreshore from the Prongs light-house to Mazagon, and to an average distance of 7,500 feet seaward. This included the Flagship moorings. The result of the survey was the discovery of many rocky patches, and also of a less depth of water on the Raleigh shoal than is at present shown on the Admiralty charts. This was a good out-turn of work, especially when it is considered the disadvantages the party was labouring under. The heat in the month of October was excessive, and there are generally unavoidable delays in the commencement of a season's work. The survey of a harbour crowded with shipping is always a tedious operation; in some instances the surveyors have to wait several hours for a vessel to swing and to watch the opportunity for running a sectional line of soundings, and during that time it frequently happens that the officers and men are obliged to remain idle in their boats until the way is clear. But, perhaps, the greatest delay in the progress of the work at Bombay was caused by the inferiority of the boats employed; they had such small horse-power and were so very wet in the slightest sea that it was at times with the greatest difficulty that work could be properly conducted. These boats made very little headway against an ordinary tide in the harbour, and, with the wind against them, they, on several occasions, were obliged to anchor.

The examination of Goa (described below) having been completed on the 16th March, the party returned to Bombay, and resumed the survey of the harbour which was extended to Elephanta, Shewa and Ooran. The Port Trust having lent a good steam launch the sounding operations were now considerably facilitated, and the survey was continued until the 15th May, when, on account of the strong tides, sea-breezes, and excessively hazy weather, the regular survey work had to be discontinued.

Between the 16th and 21st of May Lieutenant Petley made the required survey of the Entrance channel to Prince's Dock. It was too late in the season to make an elaborate examination; moreover, Mr. G. Ormiston the resident engineer, had already made a most perfect survey on a scale of 20 feet to an

inch, which was sufficient for all purposes. Under these circumstances Lieutenant Petley swept the floor of the channel down to the reported level of 57 T. H. D. The sweeps used were 5 permanent-way rails covering a space of 120 feet on each lap, and suspended by graduated marked chains, while specially made sounding leads were used, fixed to chains and long measuring-poles. Each shifting of the rails overlapped the former lap by 20 feet at one end, and 10 feet at the other, so that it was almost impossible to avoid picking up any inequalities in the bottom. It was found that, generally, the required depth had been attained; but that here and there were patches which could only be referred to the level of 58.

The result of the season's work at Bombay is that 8 miles of coast line were triangulated, and 20 square miles of soundings were taken.

GOA.

The party arrived at Panjim (new Goa) on the 27th November 1880, and were engaged until the 5th December, erecting mat houses, pitching tents, transferring stores and coal which had been left the previous season at Mormugao in charge of the commandant of that fortress. Surveying work was commenced on the 6th December. Tide poles were erected at Mormugao, Donna Paulo, and Panjim, and satisfactory results were obtained of the tidal phenomena.

The survey was completed on the 16th March 1881. The area of the work accomplished at Goa was 55 square miles of water minutely examined, the sounding lines were run in sections, those over the shoal and dangerous grounds being as close together as possible. These lines of soundings extend westward about one mile seaward of St. George's island. The soundings have been reduced to the mean of the lowest ordinary spring tides, the plane of reference being 15.26 feet below the bench-mark cut on the right-hand side of the face of the gateway by the landing jetty, leading into the Mormugao fortress. Another bench-mark was cut on the Panjim custom house; this bench-mark is 13.273 feet above low water ordinary spring tides.

The extent of coast line triangulated in the Goa territory is 72 miles, and all the topography and shore details have been carefully mapped out.

Tidal observations were continued day and night at Donna Paulo, the whole time the survey party were engaged there, and at Panjim for a period of two months.

The whole extent of land and water in the Goa territory examined by No. 1 survey party during the surveying season covers an area of about 120 square miles.

Lieutenant Petley has written a very interesting paper on Goa, which I feel will be of general interest, and it has, therefore, been printed in the appendix to this report.

RECESS.

The field survey party were discharged on the 21st May, and the officers were subsequently employed at Poona during the recess in plotting the previous season's work.

RANGOON.

No. 2, Survey party, consisting of two officers (marginally noted) a native surveyor, and the necessary equipment and establishment, was formed in Calcutta in October 1881. Lieutenant Coombs arrived in Rangoon about the middle of October, and Mr. Falle and the remainder of the party, on the 1st November.

A steam launch and other necessary boats were supplied by the Port Trust of Rangoon.

The work was commenced on the 1st November and completed on the 24th March 1881.

The portion surveyed was on a scale of 400 feet equal to one inch, and comprised that part of the river within the limits of the Port of Rangoon, including part of the Pegu River and Poozoondoung Creek. It was necessary to re-measure the foreshore, as changes had taken place in the coast line since Mr. Seaton's survey of 1877-78. The high and low lines were carefully delineated, and the river closely sounded in sections varying from 200 to 400 feet apart. The total space sounded was about 8 square miles. The length of coast measured was a little more than 20 miles.

On the 6th December 1880, it having been reported that the shoals at the mouth of the Rangoon river had undergone considerable changes since they were last surveyed, Lieutenant Coombs was ordered by telegram from Calcutta to proceed down the river to re-examine and report upon the encroachment on the channel of the Middle bank. The Indian Government Steamer *Irrawaddy* having been placed at his disposal, he left Rangoon on the following day and proceeded to the surveying ground, anchoring off the middle bank. The result of this examination Lieutenant Coombs reported at the time as follows:—"We anchored just above the Black Buoy marking the channel, as shown in Navigating Lieutenant Jarrad's chart of 1875, and having fixed some secondary stations, sounded the channel sectionally at distances of a cable. I find that the middle Bank shoal has extended to the southward and eastward; and at a distance of 9 cables south-east by east of the buoy, where on Mr. Jarrad's chart is shown a depth of 45 feet, there is now only a depth of 8 feet. A new buoy has been placed in 24 feet, distant $6\frac{1}{2}$ cables south-east $\frac{1}{2}$ east (magnetic) from the old one; and $1\frac{1}{2}$ cables to the northward of this, there is now only 9 feet where formerly there was 18. The extension of this shoal necessarily narrows the channel, and, although the action of the water has cut away the foreshore inside and to the northward of Elephant Point in some places as much as half a cable, yet the channel is now in its narrowest part only $2\frac{1}{2}$ cables in width, as compared with 4 cables, its width in 1875."

The survey of the port of Rangoon occupied a longer period than was anticipated, in consequence of the many drawbacks the party had to contend with, principally on account of the men, lent by the Rangoon Port Trust for the survey, being wholly untrained, and the steam-boat supplied being but poorly adapted for the requirements. With regard to the former, they were Chittagong men, and quite unaccustomed to the hard work; on more than one occasion the greater number deserted, as they were able to obtain the same pay for lighter work elsewhere. The men were used simply as boatmen and coolies. The steam cutter supplied to the party was old and quite unadapted for the work. She would barely make headway against the strong tides of the Rangoon river, and when used two or three days consecutively frequently broke down, and required to be laid up for repairs. This occurred several times during the progress of the work. For these reasons the survey was much hindered, and, in January, the river began to fill with shipping on account of the rice season having commenced; and the ships anchoring on the section lines retarded the sounding operations. Another cause of delay arose from the Burmese on several occasions removing the pegs which marked the sections, and the flags used for secondary stations, thinking that their land was being re-parcelled or re-allotted.

These drawbacks caused the survey to be protracted later than was expected, and in February the heavy fogs, for which the country is notorious, set in, lasting sometimes from 6 A.M. until after 10 A.M., for a week at a time, and these occurred during the neap tides, the only time the sounding work could be carried on.

The health of the party was generally not good, some of the men being constantly on the sick list. Both officers in charge were on different occasions laid up with fever, originally contracted during the survey of Karwar in the previous season.

During the last ten days the party remained at Rangoon, a plan of the site of the proposed new iron screw-pile jetty was made by request of the Port Commissioners, on a scale of 25 feet equal to one inch.

On the 31st March the party left Rangoon and arrived at Calcutta on 4th April.

Lieutenant Coombs has compiled some interesting notes concerning Rangoon, which will be found in the appendix to this report.

FALSE POINT.

During the latter half of the month of April 1881, Mr. P. J. Falle, Assistant Superintendent, 2nd grade, was sent to False Point to make a careful survey of that portion of Dowdeswell island lying north of Hukitollah, the part of the island most seriously affected by the action of the winds and waves of the southerly monsoon, as also by the river freshets. This survey was executed on a scale of 400 feet to an inch, and will be valuable for comparison with the more extended survey now being carried on.

In the months of August and September, 1881, Mr. Falle was again deputed to False point for the purpose of reporting on the set and velocity of the tides in the harbour. This officer's report on this subject will be found in the appendix. I regret to say that Mr. Falle contracted fever while thus engaged, and, upon his return to Calcutta, was compelled at once to take sick leave.

RECESS.

During the recess Lieutenant Coombs was employed in the head-quarters office, Calcutta, in plotting and preparing the sheets of the survey of the port of Rangoon. Mr. P. J. Falle availed himself of 3 months' privilege leave.

TOTAL OUT-TURN OF SEASON'S WORK.

The total outturn of work performed by the officers of the department during the season 1880-81 is as follows:—

Coast line (in detail)	. . . . .	10½ miles.
Water sounded	. . . . .	82 square miles.
Total linear miles of soundings	. . . . .	1,006 miles.

The above does not include the examination of Prince's Dock Channel (Bombay), nor that of the channel in the Rangoon river near Elephant Point, nor the site of the proposed new iron screw jetty at Rangoon, as they severally occupied the survey parties but a few days.

APPENDICES.

Extract from the Narrative Report, dated 15th August 1881, by NAVIGATING LIEUTENANT E. W. PETLEY R.N., F.R.G.S., Assistant Superintendent, Marine Surveys, in charge Goa Survey.

The whole of the Survey party arrived at Panjim (New Goa) by the 27th November; and after calling upon the Governor General, I moved the party to Donna Paulo bay, that being the most central position for our work. His Excellency the Governor General very kindly ordered mat houses to be built, lent us spare tents, and issued instructions to all officials to give us every assistance in their power, and at the same time verbally informed me that, should any difficulty arise, I was to apply personally to him, of which privilege I was frequently glad to avail myself. There can be no doubt that the interest the Governor General of Goa took in the work considerably accelerated the progress of the survey. The natives had some idea that we were connected with the new treaty respecting the salt tax, which appears to be most unpopular with them; it was subsequently rumoured amongst them that we were measuring the land with a view to its valuation and purchase by the British Government, so that they commenced annoying us by stealing our flags, which took us sometimes a whole day to replace, when the flag station was about 8 and 9 miles off, involving a walk over the laterite hills of about 16 miles. His Excellency managed to stop the thieving of the flags; but the natives then took to cutting the ropes that supported the flag poles, thus the same damage was done without the risk of any person being caught in possession of the property.

There were many other petty annoyances of daily occurrence of which it was impossible to be always informing the Governor General; but without his help we should not have even received common civility. Sometimes the people even refused to sell us a cocoanut, and at the best of times we paid at the least double for every thing. Some difficulties arose as to the hire of coolies, but with judicious management this was overcome.

The Survey party were engaged until the 5th December, erecting mat houses, pitching tents, and transferring the stores and coal which had been left at Mormugao in charge of the commandant of the Fortress, and which was found all in good order. Surveying work was again commenced on the 6th. Tide poles were erected at Mormugao, at Donna Paulo and Panjim, and satisfactory results have been obtained.

I considered it for many reasons advantageous to take up the survey of Cabo Head with outlying reefs before attempting the general sheet of Agoada to St. George's islands, and a very tedious piece of work it proved to be. It was, however, completed by the 20th of January, and the result has been a most carefully worked up sheet connecting the water area with that done off the Mormugao shore last season, and thoroughly delineating the extent of the Sunchi reefs and Amée shoals, and also clearing up all the doubtful spots marked on the existing charts. I must here mention that the examination of the locality of the Sunchi reef was carried out under extreme difficulty and sometimes danger, as, when working there, the sea, to all appearances quite smooth, would suddenly, in a most unaccountable way, pile up on the reef and develop into tremendous breakers; it has many times nearly caught the boats, and, with the place full of sharks, it was anything but a pleasant idea to feel our one might be capsized at any moment.

The remaining portion of Goa Territory was surveyed on 3 inches equal to one nautic mile. This was taken in hand immediately the 600-foot scale plan was completed, and having some considerable experience of the weather to be expected at that time of the year, I decided to employ all the staff on the seaward portion of the work before taking up the rivers.

The triangulation of the coast was extended, and connected with the stations left last season, and the work of carrying on the outer soundings was pushed on with all vigour, and, I am glad to say, was completed by about the 20th February, besides which all the seaboard coast line with outlying islands had been carefully mapped. In carrying out the above, Mr. Searle and myself camped at St. George's island, and Navigating Lieutenant Pascoe was left in charge of Head-quarters to look after the plotting of the soundings, &c., which had accumulated considerably.

The remainder of the work ordered to be surveyed in Goa territory was completed on the 16th March.

DESCRIPTION OF GOA.

I now propose to give a descriptive sketch of the forts, churches, rivers and islands, &c., visited by us during our stay in that country, commencing with Agoada Head.

Agoada (from *Agoa*, "water,"), on account of the abundance of good water procurable at that place, is a large headland of laterite rocks situated on the south-west end of the pro-

vince of Bardez, and forms the northern limit of Goa Bay; it is about $1\frac{1}{2}$ miles in length, and is fortified round the base of the hill on the north, and partly on the south and west sides. The upper fort or citadel stands on the highest part of the headland, and is connected with the lower fortifications by a covered way.

The light-house stands within the citadel and contains a clock and bell, the latter being the largest in Goa, and is said to have once belonged to the convent of St. Augustine at Old

Goa. There is also an excavated reservoir or cistern of large dimensions, and supposed to be capable of containing $2\frac{1}{2}$ millions of gallons of water. This structure is now disused on account of the state of decay it has been allowed to fall into. There is also a signal station with flagstaff on the north-west bastion of the citadel. Within the lower fort the buildings that were once used as barracks are now converted into a convict establishment, with a guard of sixty officers and men; the whole of which are under the commandant of the fort, whose residence, as also those of the Custom House officer, pilot and jailor, are situated outside the fort; there is also a landing pier and saluting battery.

A church called St. Lorenzo stands on the summit of the hill about half a mile to the eastward of the light-house, and which is very conspicuous from seaward; it was built about the year 1640, and appears to be kept in a fair state of repair. At the base of the hill under the church is the small battery of St. Lorenzo, no doubt placed there for the protection of the landing place. From the lower fort an excellent road leads over the headland, past St. Lorenzo church, and ends at a small naval establishment on the right bank of Sanguerim Creek.

Agoada headland to the eastward terminates in high red cliff, with a small plateau covered with cocoanut trees at the base; this point is called Mama point, and forms the entrance of the right bank into Sanguerim Creek.

Sanguerim creek, which is only about 5 miles long, drains two small valleys, and winds in a general westerly direction as far as the village of Candolim, when it turns and runs nearly south, skirting the north-east side of Agoada headland, and discharges its water into Agoada Bay. This creek is tidal throughout its whole extent, and small pattimars, by taking advantage of the tide, can go beyond Candolim village, where they load principally with cocoanuts and salt. The banks on both sides of the creek are built bunds, with numerous sluices for regulating the supply of water to the salt pans that are now worked under the supervision of an official belonging to the British Government. Candolim is the most populous village on this creek, and is situated about $2\frac{1}{2}$ miles from the entrance. On the hill above the village are two large banyan trees, which are very conspicuous landmarks. From the entrance of Sanguerim creek and eastward to Reis Magos fort, cocoanut groves extend the whole distance, while the summit of Reis Hill above is quite barren.

Reis Magos fort, on the north side of Mandovi river, stands about half a mile westward of Panjim, and, in conjunction with Gaspar Dias on the south side of the river, commands the entrance, as vessels proceeding into the river must necessarily pass very close to both forts to avoid shoals. This fort is built on the south-east extreme of Reis hill, and somewhat in the same style as Agoada, but on a much smaller scale; it comprises an upper fort built in the shape of a triangle on the summit of the hill, and is connected with the lower fort, which is on the sea-shore, by two high walls containing covered ways; these walls are not fortified.

Close below and eastward of Reis Magos fort is the fine church of the same name, the principal entrance to which has a magnificent flight of steps; the remains of one of the Viceroys of Goa are interred here. The hill to the north and west of the fort is quite bare, but from Reis Magos church to Verem, the slopes of the hills are covered with thick jungle, and the shore around Verem Bay is faced with a sea-wall; this place is thickly populated. From Verem at the head of the bay there is communication with Panjim by steam ferry; and a good cart road leads from here to Mapuca and Chapora; small foot-paths lead to the several villages along the banks of the Sanguerim river. The whole of the flat land around the villages between the hills, which here run down close to the river in a series of points, is taken up with cocoanut groves, and continues round the river margin and up the right bank of the Mapuca river.

Chorão Island (on the right bank of Mandovi river, and opposite Ribandar) is an irregularly shaped island running in a north-north-east and south-south-west direction, and is about $3\frac{1}{2}$ miles long and $2\frac{1}{2}$ miles wide in its greatest breadth. The south side of the island is low, the banks being wholly artificial, and the cultivated soil is below the level of high water; the shore is fringed with mangroves, and extensive mud flats extend off the south and west sides, making it difficult to land except at high water. The east side is comparatively clear, and landing may be effected at any time of tide at a small jetty at the south-east corner of the island, whence a road leads to the village of Orondo and to the church of the Assumption, situated on the summit of a hill about one mile from the landing place. About Orondo and to the north the ground is higher, and consequently better cultivated than the marshy land to the South.

Divar Island, forming the right bank of the Rio de Goa, is separated from Chorao by the Naroa river, which has only 5 or 6 feet water in it at low water, and at the entrance is narrowed to only 600 feet in width, by an extensive mud bank, which extends along the west side of the island. The south side of the island being on the Goa river is comparatively steep to. The south-west part of Divar Island is marshy land with a few salt pans scattered here and there, and is much cut up with numerous creeks. About 2 miles north-east of the south-west point of the island the large church of Piedade stands on a hill, a very conspicuous landmark. At the foot of this hill is the village of Navelim, in a cocoanut grove, the surrounding

country being slightly cultivated; like Chorão the shores of Divar Island are all *artificial*, but the bunds do not appear to be kept in such good order as in Charão. The general direction of Divar Island is north-east and south-west, and the island is about $3\frac{1}{4}$ miles long and $1\frac{1}{4}$ broad.

The cultivators of both Choro and Divar Island appear of late to have been continually reclaiming the land. Each successive year they add more soil to their property by putting down bunds at low water, and as the silt accumulates behind it during the year they place another bund beyond the former one; these embankments are now seriously narrowing the rivers. The natives informed me that this land was fit to cultivate after three years, and that it was splendid for rice cultivation; they further told me that there was no hindrance to their reclaiming as much as they wished as long as it did not cost the Government anything. There are a few disused salt-pans on these islands.

On the south side, or left bank of the Goa river, and opposite Divar Island, is situated Old Goa. So many and such good descriptions having been published of this once famous place in the world's history, anything further that I could add would be superfluous; but it may be

Old Goa.

noted that the body of the patron Saint of Goa, St. Francis Xavier, is still preserved at Goa in the Church of Bom Jesus, the more superstitious of the Goanese believing that while the Saint remains in Goanese territory Goa cannot be severed from the Portuguese dominion. The fine churches and monastic buildings have fallen into the last stage of decay, while other buildings, such as the Palace of the Viceroy and the Inquisition, exist only in name, nothing remaining but heaps of stones, covered with creepers, to mark the spots on which they once stood.

From Old Goa to Ribandar a good carriage road runs by the side of the river; the distance being $2\frac{1}{4}$ miles; the slopes of the hills, which run down to the road, are covered with thick jungle, while cocoanut groves fill up the valleys between the several spurs. Midway between the two places, is the village of Panelim, where there is a hospital for the poor, supported by the State, and also a large magazine.

Ribandar, situated about half way between Old Goa and Panjim, lies on the slope of a hill, and is connected with the latter place by a fine causeway nearly 2 miles long, which forms the south bank of the river between the two places. Ribandar is at present the residence of the more wealthy of the high officials of the State and other gentlemen of position. There is a fine church here which is said to have been erected by some devout sailors, in commemoration of their preservation from shipwreck and safe arrival in port after having encountered severe storms on their passage from Portugal; it is said to be the exact length and width of the ship saved.

The Ribandar causeway, from an inscription cut in the laterite masonry, was built in 1634 and on the land side contains extensive salt works, beyond which cocoanut groves and cultivation extend to the foot of the hill.

Panjim, the modern capital of Portuguese India, is situated on the left bank of the Mandovi river, and from the opposite shore has the appearance of a clean and well built city. The public edifices and numerous other houses in the more respectable portion of the town, are double-storeyed, and all the houses are neatly painted.

Panjim.

The shore frontage has been reclaimed and a fine sea wall is being erected, which, when completed, will front the whole of the town. The most prominent building in the town when seen from the river is the Governor General's palace, which stands on the river bank and about the centre of the town. This palace was formerly a Mahomedan castle, and was converted into a viceregal palace about the 17th century; it has since been so modernised that none of the remains of a castle can now be detected, at least outwardly.

The space between the palace and the river is made into a garden, and there is a good landing place just outside the grounds. The south side of the palace, where is the principal entrance, opens out into a square, on one side of which is the Accountant General's Office, and, in close proximity, the post office and jail, while to the west of the palace are the Secretariat and Public Works offices. The Telegraph Office is situated at the extreme east end of the town near the river, where are also the Municipal Offices. The High Court, the top of which is surmounted by a clock tower and flagstaff, is situated at the south end of the public gardens and close to the parish church of Panjim (Nossa Senhora da Conceicao). This fine church, with dwelling house for the priest, is built on the side of Panjim hill, and is approached from the west by stone steps in three flights, and ending at the top in a terrace in front of the church. The west front is very fine, and is a conspicuous object when viewed from a vessel coming round Agoada head from the north.

The Custom House is on the river bank to the west of the palace, and has a landing pier in front of it; to the west of this again are the Archbishop's palace and military barracks, the latter being the largest building in Panjim, with a fine central quadrangle where the men are drilled. The south-east corner of the barracks is occupied as a public library and high school. Immediately west of the barracks is the new market place (which was formally opened on the 1st January 1881), in the centre of which is a pillar with inscription recording the fact. On the extreme west of the town is the Military Hospital with chapel attached; it is a very fine building, and quite open to the sea breeze, there being nothing but the Campal, a large open space, between it and the sea.

Until within the last few years the west end of Panjim was a mass of cocoanut groves, which shut off the sea breeze from the town; but, during the tenure of office of the present Viceroy, broad roads have been made, running east and west right through the town; this, of

course, has entailed great expense on the municipality, but the benefit, as regards sanitary arrangements, is undoubted. A large piece of work with the same object is now being carried out between Panjim and that part called Fontainhas, namely a deep cutting through Panjim hill, immediately south of the parish church; the idea is to allow the sea breeze to get through to that part, which is the most thickly populated of Panjim, and also to create easier means of communication between the two quarters of the town.

On Panjim hill, immediately above the church and close to the new cutting, is a large old banyan tree, which is used by the pilots as a mark for crossing the bar at the river entrance, and just north of this tree is a semaphore and signal station, from which the 12 o'clock gun is fired every day.

In the large square are very prettily laid out public gardens, in the centre of which is a band stand, where a military band plays twice a week.

Fontainhas is, as has been before mentioned, the most densely populated part of Panjim, whilst that part to the west of Panjim hill is composed of fine buildings and houses of the better classes. Fontainhas, which is situated along the east base of the hill, consists of houses of the lower order, these houses are built between the hill and the bank of a small tidal creek, which is nearly dry at low water; this creek is a feeder to the numerous salt pans which are worked about here, the mouth opening out into the Mandovi river at the east end of Panjim. The creek, being a natural sewer for the drains from Fontainhas, is at low water most offensive, and in the hot season typhus fever is rife about this part. One long street runs through Fontainhas and is kept very clean indeed; this also may be said of all the streets and roads of Panjim, the municipal sweepers in this respect appearing to do their work thoroughly. The sweepings of the town are supposed to be taken out in the river and thrown overboard clear of the town, but I have seen them deposited in Fontainhas creek, which cannot be conducive to the health of that locality.

Panjim hill, which rises immediately south of the town, is on its north part quite destitute of vegetation, with the exception of one or two solitary trees, but the south end is covered with thick jungle; the extreme north-west point of the hill is a steep red cliff, which in line with the banian tree before mentioned is the mark for crossing the river bar. At the foot of the hill on the west side, is the church of St. Ignaz, and close to it the remains of a large building, which was at one time the palace of the Archbishop of Goa. Beyond this palace and church runs the high road from Panjim to Donna Paulo Bay and Cabo convent, passing through the small village of Caranzalem, a place of resort amongst the upper classes during the hot months of April and May; this place being situated near the sea the whole of the benefit of the sea breeze is experienced, which at that period of the year blows strong in the afternoon from about the north-west. Following the beach south from Panjim, about two-thirds of a mile from the hospital is a new slaughter house recently erected, which is a conspicuous object from the sea. At $1\frac{1}{2}$ miles from the hospital, and situated on the beach, is the small fort of Gaspar Dias; it is of irregular shape and very low, consequently not easily distinguished from the sea. It is at present unoccupied, but is about to be transformed into a jail. From the hospital to Caranzalem the shore forms a sandy beach backed by extensive cocoanut groves and patches of cultivation. The crops principally grown about here are sweet potatoes, chillies and other vegetables, while immense numbers of cashew trees grow on the less productive parts of the land, from the fruit of which is distilled a slightly acrid wine, as also a strong spirit.

From Caranzalem the land becomes hilly, running out into the sea towards the north-west and terminating in a headland called Cabo, the shores of this headland are precipitous and rocky, and off the south west side reefs and dangers extend for a great distance. On the headland stands a large structure, at present the summer residence of the Viceroy; this building was formerly a Franciscan convent, and has a small chapel attached. The extreme of this

Cabo.

headland was at one time fortified, the convent standing within the citadel, but nothing now remains of the fortification with the exception of one or two bastions, and a gate way at the base of the hill, both of which are in a very dilapidated state; only about 200 feet of sea wall is in anything like repair. About half a mile from the convent, and on the south side of the hill, is a small English cemetery, which is the only thing now left to mark our occupation of Cabo, which we did for a short time prior to the general peace of 1815, the numerous buildings that were erected at that time having been destroyed by the Portuguese.

From Cabo the land trends to the eastward preserving the same bold appearance (and forming the north side of the extensive bay of Mormugao) for about 4 miles, when it turns to the south for about $1\frac{1}{2}$ miles, terminating in Nazareth Point. At $1\frac{1}{4}$ mile from Cabo is the small bay of Donna Paulo, where there is a small fishing village and jetty, the latter terminating the road from Panjim. This landing place was in former times fortified; the remains of the walls are still easily traced.

Further east are the villages of Oexel and Cacara on the shore, and off the points of the same name extend reefs for some distance. The shore is fronted with rocks with occasional patches of sandy beach. Bambolim is a small village, with a church, in a little valley; just south of Bambolim the hills turn and trend north and east for some miles, forming an immense valley, which is extremely fertile, and abounding in cocoanut groves, &c.; in it are several villages, the one at the head of the valley is called S'ta Anna. A stream runs through this valley emptying itself into the Zuari river about one mile east of Nazareth Point; it is tidal for a considerable distance, and is the feeder to the large salt pans that are worked about here; the banks are artificial. Conspicuous on the east side of this valley is the church and convent of Pilar, which stands on the brow of a hill about 2 miles to the eastward of Nazareth Point;

while below it, in the valley, are the villages of Goa Velha (the true Old Goa) and Batim. The main road (a cart road) from Panjim, which passes through S'ta Cruz, and over the hills near Bambolim, descends into the valley near Carea, is bridged over the stream at Juarim, and passes through Goa Velha and directly under Pilar church, whence it goes nearly due south to Dandim and the river bank. This road is the means of communication between Panjim and Salcette during the south-west monsoon; the ferry being at Cortalim, it is dangerous for small boats to attempt to cross Mormugao Bay during that season.

Nazareth point is easily recognized by a dome-shaped chapel on its summit, about 50 feet above the sea; the point slopes to the northward. Between Nazareth point and Dandim the shore forms a large bight, which is filled by an immense mud flat, dry at low water. Juarim creek opens in this bight. There is a small islet on this mud flat with the remains of a large cross in the centre. At Dandim, near where the road meets the river, is the ruin of a small fort called St. Lawrence. The Zuari river, off this fort, deepens considerably, and shoals towards the bar, where it has only 7 feet at low tide, about halfway between Nazareth and Chiquilim points.

As the survey terminated at Cortalim point, remarks may now be made of the south or left bank of the Zuari river, working west, to south side of Mormugao Bay.

From Cortalim point to Alparqueries point the shore runs east and west with large bights, very shallow, and which dry at low water, the prevalent nature of the bottom being mud. From the shore the hills rise to a height of from 200 to 250 feet, terminating in flat table-land of laterite rock, on which there is little or no vegetation. Cortalim, lying to the

Zuari river.

south of the point, is a village of some considerable importance, with a large church, which is conspicuous from the river; the land about here is well cultivated, extensive cocoanut groves extending as far as Sancoale point, or about one mile further west. At $2\frac{1}{4}$ miles west of Cortalim is the island of Secretario, which is precipitous and covered with thick jungle; on the south side is a small piece of level ground on which stands the church of St. Jaxinto and a few houses, this side of the island is also fortified. The island is connected with the mainland at low water by a mud flat. Half a mile further west is the small rocky islet of Verey, which is joined to the main land at low water by a long narrow strip of sand; on this islet are the remains of a large cross. In the bight to the south-west stands the little village and church of Chiquilim in the middle of cocoanut groves; a footpath connects this place with Cortalim. Between Chiquilim point, which is north of the village of that name, and Alparqueries point, is a bight with the small village of Verem at its head. The land from Verem to Mormugao is flat and cultivated, making the headland of which Alparqueries point is the north extreme, an isolated hill between 130 and 140 feet high, flat-topped with steep side, and on its north and west side comparatively steep to, and having from 2 to 3 fathoms of water close to the rocks. West of Alparqueries point is the headland of Mormugao, a description of which was given in last year's Annual Report.

The west side of the headland partakes of the same feature as the north and east side being precipitous and rocky; where at all accessible it has been protected by fortified walls, which are now crumbling into decay, but the works are very slight compared with the extensive fortifications on the other side of the headland.

To the westward of Mormugao headland, and about one mile off, is the islet of Cumbarum, or as it is called on English charts 'Buffalo rock'; it is composed of laterite and trap rock, forming in two little peaks, the highest being about 20 feet above the sea. This rock has such a large percentage of iron in its composition that magnetic observations on it are impossible. Excellent edible oysters are to be got here at low tides. To the south of Mormugao headland is the large bay of Chicolim, with a stretch of sandy beach more than a mile long, terminating to the south at Bimbay point, which is steep and rocky.

Off Bimbay point lies one of the islands of St. George's group, which is oval in shape with precipitous sides and flat top, the island is covered with dense jungle, where the natives from the main land opposite obtain their firewood. There is no good landing place on this

St. George's islands.

island. It is steep-to, there being from 2 to 4 fathoms within a cables' distance of it all round; between it and the shore is a clear channel with 5 fathoms at low water. Great St. George island, which is situated to the southwest of the small island about $1\frac{1}{2}$ miles distant, is $1\frac{1}{2}$ miles long, it is really composed of two islands, which are nearly joined together at low water by rocks, but at high water small boats can pass between the two. The most westerly of these two islands is cone shaped, sloping gradually to the eastward, the apex of the cone is a Great Trigonometrical Survey Station. There is a small spring of excellent water on the south side. The large island is long and wedge-shaped, gradually rising from the west to the eastward, the latter being the highest part. This island is, like the other, uninhabited, and covered with jungle, no animals with the exception of cats were seen, but numerous colonies of flying foxes have settled here; natives also say that there are immense snakes of 20 and 30 feet long on the island but no venomous ones.

At the south-east corner of this island is a landing place with a spring of excellent water near a single cocoanut tree. Fishermen from Ratnagiri and Malwan visit these islands, for drying and curing their fish; the ground about here being excellent fishing ground. Around the cliff of these islands are a great number of blue pigeons. The north sides of the islands are comparatively clear from dangers, but on the south side numerous reefs extend off the whole length of and parallel to the island, the most southern danger being the Sail rock, which lies about $1\frac{1}{2}$ miles south of the West-St. George.

The coast south of Bimbay point runs south-east as far as Santarim point, a distance of $2\frac{1}{2}$ miles, when it trends to the eastward; it is steep-to, the rocks off the points extending only about 150 to 200 feet off shore, and the coast is bold rising to table-land about 100 feet high. Issossim Bay, which is $1\frac{1}{2}$ miles from Bimbay point, is a small sandy bay with deep water in it; there is generally a nasty surf, which makes it difficult for boats to land, the best landing is at the north end. At the back of this bay a small valley runs to the southward, where is also a small village called Bogmara; the valley is filled with cocoanut groves and paddy fields. As a short half mile to the south of Santarim point was the limit of the survey, I have no further remarks to make on the coast features.

Goa territory is intersected by numerous rivers and creeks, the principal being the Mandovi and Zúari; the others—namely, the Tiracol, Chapara, Baga, Sal and Talpona rivers—varying in length from 7 to 18 miles, and are only used by pattimars and country craft.

The Mandovi river, which rises in the Parvor Ghât, in the province of Satari, is $38\frac{1}{2}$ miles long, dividing the districts of Ponda and Bicholim, and then, forming some islands off the entrance to the Cumbarjua creek, passes Panjim and finally discharges its waters into Agoada Bay.

The principal branches of the Mandovi drain the villages of Mapucá, Tivim and Assonóra, and are named after the localities through which they pass. This river is the most important in Goa Territory, as both the ancient and modern cities have been built on its banks.

In comparing the depth of water obtained during the recent survey with that obtained by Captain Inverarity in 1812, there is no difference in the depth over the bar, nor does it appear to have altered its position since that time, as the leading marks then given are the same as those now used.

There is, however, an appreciable difference of the depth about halfway between Gaspar Dias and Reis sand, and also again from the north of the Mapuca river to Old Goa, the diminution in some places being now as much as from 6 to 8 feet. The anchorage off Panjim seems to have about the same depths.

Notes on Rangoon. Compiled from various authorities by LIEUTENANT W. H. COOMBS, R.N., Assistant Superintendent of Marine Surveys, in charge of Rangoon Survey.

The Hlaing River—rises in the mountains near Prome as the Zay, and flowing in a S. S. E. direction past Rangoon, enters the Gulf of Martaban as the Rangoon river. Just below the town of Rangoon it is joined by the Pegu and Poozoondoung rivers. It is navigable by the largest sea-going vessels as far as Rangoon, and during spring-tides large ships can ascend much higher. Just below Rangoon the Hastings Shoal, caused by the meeting of the three rivers mentioned above, stretches across the river, and at times bars the approach of ships of heavy draught.

The Poozoondoung River—rises in the eastern slopes of the southern spurs of the Pegu Roma mountains, and after a south-easterly course of 53 miles joins the Rangoon River as before mentioned; on account of its silting up, owing to the vast quantities of rice husk discharged from the mills erected on either bank, it is now only navigable for boats.

The Pegu River—rises in the eastern slopes of the Pegu Roma. During the rains it is navigable by river steamers and the largest boats as far as Pegu, but during the remainder of the year large boats can ascend during spring tides only.

The capital of the province of that name is situated on the Hlaing or Rangoon river, 21 miles from the sea. According to Talaing traditions the first village established on the site of the present Rangoon was founded about 585 B.C. It was originally called Dagon, but in A.D. 1763 it was taken by the Burman King, Aloon Bhoora, from the Peguans. He rebuilt the town and called it Rankoon¹ or Rangoon, the name it has ever since borne. From this date until 1852, when it was for the second time taken by the British, the town seems to have been little more than a cluster of huts, and the accounts given by Snodgrass,² Wilson, and others, describe it as "a vast assemblage of wooden huts surrounded by a stockade 16 to 18 feet in height." The town, such as it was in 1840, was close to the river bank, but in 1841 King Koon-boung-meng, better known as Prince Tharrawaddy, removed the principal buildings and government offices a mile inland and surrounded them with an earthen embankment 16 feet high and 8 feet broad at the top. This was its position when the British force landed and captured Rangoon in April 1852. Between the new town and the river the ground was generally low and swampy, and under water during spring-tides, yet it had not been entirely deserted. Within six months of its capture by the British, steps were taken for laying it out in regular streets, for raising the general level, and for keeping out the river. The work of improvement was continued year by year, and the Rangoon of to-day is as unlike the Rangoon of 1852 as modern London is unlike the London of 500 years ago. The greater portion of the town and the military cantonments are on the left bank of the river, but there are some large docks and factories on the opposite Dalla shore. The principal buildings are the government and public offices on the Strand, the Holy Trinity Church, the Bank of Bengal, the Custom House, the Sailors' Home and the Municipal Market. There is a railway to Prome, a single line with a gauge of 3·28 feet, with a terminus in the centre of the town.

The most conspicuous object in Rangoon is the famous Shwe Dagon Pagoda, the most celebrated place of worship in all the Indo-Chinese countries. This pagoda was, it is asserted, founded about 585 B.C. Poo (*dove*), and Tapau (*plenty*), sons of the King of Twanté, who had received some of Gaudama's hairs from Budha himself, and acting on his instructions, buried them on the summit of a laterite elevation, and erected over them the Shwe Dagon Pagoda. But the first trustworthy statements are those which relate to the works carried out by Queen Sheng-tsaw-boo in the latter half of the 15th century. This sovereign raised its height to 292 feet, made terraces on the hill, paved the topmost one with stone, and set apart land and hereditary slaves for the service of the shrine. From time to time the building has been enlarged and beautified, and in 1871 was entirely re-gilt, and a new *htee* of iron, covered with solid gold, and inlaid with numerous jewels and precious stones, manufactured at Mandalay at a cost of Rs. 6,20,000, was placed upon it. The existing building is 320 feet in height, and 1,130 feet in circumference at the base. The hill on which it stands has of late years been to some extent fortified by the English Government.

The Poozoondoung river joins the Rangoon river at an acute angle in the extreme east; this point of junction is called Monkey Point, and is surmounted by a battery, the guns of which sweep the approach to the town by river. Stretching along the banks of the Poozoondoung is the Poozoondoung quarter, separated from the central portion of Rangoon by rice fields, and swampy ground covered with mangrove, and connected with it by raised and metalled roads. Here are the principal rice-husking mills. Along the bank of the river between Monkey Point and Rangoon is the Botahtoung quarter, and here on the edge of the river are numerous steam saw mills.

Between the shore and the Hastings Shoal is the deep channel approach to the town, called Monkey Point Channel, which has a least depth of 19 feet at low-water ordinary spring-tides. Smaller vessels, drawing less than 12 feet, can pass out over the Hastings Shoal, except at low-water spring-tides. Above Rangoon at the bend of the river is the Aloon quarter,

¹ "The end of the war," from *ran war and koon* (Euph. *goon*), to be finished.

² Narrative of the Burmese War, 1827 and 1852.

where is the Government timber depôt, and above this again is Kemendine, where there is a railway station. This quarter is occupied principally by Burmese, but there are two or three steam rice and saw mills.

Wharves.—On either bank of the river opposite the town are numerous wharves and jetties, of which the principal are those off Godwin Street (the Commissariat wharf), Latter Street, Soolay Pagoda Street, and Phayre Street. A large iron screw-pile jetty has just been commenced opposite Lewis Street, intended to supersede the present Master Attendant's wooden wharf.

Garrison.—After the close of the second Anglo-Burmese war the garrison of Rangoon was gradually reduced in strength till 1862, when considerable changes were made. In 1878 it consisted of two batteries of Artillery, one battalion of European and one battalion of Native Infantry, with a detail of Sappers, all belonging or attached to the Madras Army, and quartered in the cantonment, which extends east and west behind the town, near the Shwe Dagon Pagoda. Since that date to the present time, on account of the disturbances in Upper Burma, constant changes have been taking place in the strength of the garrison.

The revenues of the town are raised and managed by a Municipal Committee, first appointed in 1874, by whom great improvements have been carried out.

The charge of the Port and Port Funds is undertaken by a Port Trust Committee.

Population.—The population of Rangoon in 1795 was about 25,000, but in 1812 there were only about 7,500. The Anglo-Burmese war having given an impetus to trade, the population of Rangoon from that time rapidly increased. The annual returns show the population in each year from 1863 to have been—

Year.	Population.	Year.	Population.
1863	61,138	1872	77,777
1864	63,206	1873	80,096
1865	66,577	1874	81,244
1866	69,866	1875	80,494
1867	71,186	1876	83,222
1868	72,675	1877	91,458
1869	96,942	1878	110,700
1870	93,163	1879	95,179
1871	100,000	1880	98,779

Few towns present such a motley assemblage as jostle each other in the streets of Rangoon. Every quarter of the globe is represented, and loafers from all parts of the world are to be met with.

The census of 1872 gives the following returns:—

Europeans and Eurasians	3,789	Shan	1,217
Africans	31	Arakanese	195
Australians	4	Kathays	31
Americans	43	Armenians	187
Hindocs	15,261	Malays	127
Moguls	416	Arabs	29
Pathans	19	Afghans	2
Suratees	815	Jews	85
Burmese	56,918	Parais	18
Talaing	7,451	Siamese	53
Kareng	525	Chinese	3,181

The returns of the census of 1881, including travellers and the shipping in port, show the present population of Rangoon to be 132,004.

Trade.—About the middle of the seventeenth century European factories were first established in and around Rangoon, but these, owing to the unsettled state of the country, carried on but little trade, and it was not until after the conquest of Pegu by the Burmans about the end of the last century that any great development took place in commerce; when Pegu passed to the English, trade began to improve and has progressed with vast strides, until at the present time Rangoon has become the third port in India. Cotton piece-goods, salt, and spices are the principal imports, while rice, timber, catch, hides and petroleum are the chief items in the export trade.

The value in rupees of the export and import trade, excluding treasure, has been—

Year.	Imports.	Exports.	Total.
	Rs.	Rs.	Rs.
1858-59	1,27,43,744	85,66,817	2,13,10,561
1868-69	2,34,64,602	1,95,40,551	4,30,05,153
1878-79	4,66,78,746	4,62,81,059	9,29,59,805

The rice season commences in January and ends in May, and during these months the number of vessels visiting Rangoon from all parts of the world is very considerable.

The average gross tonnage per annum for the seven years 1873-80 of vessels entering the port of Rangoon was 547,962, and of vessels leaving the port 536,014 tons, the average amount received yearly for Customs duties during the same period being Rs. 30,02,072.

Report on the Set and Velocity of Tides at False Point Harbour during the months of August and September 1881, by MR. P. J. FALLE, Assistant Superintendent of Marine Surveys.

Under instructions contained in Superintendent of Marine Surveys' letter, No. 63, dated 18th August 1881, I proceeded to False Point per S.S. *Culina*, on the 19th August, accompanied by one sookanie and two leadsmen.

On my arrival, on the 21st, the launch *Maria Theresa* was placed at my disposal by the Superintending Engineer, Cuttack, and although of an excessive draught, *viz.*, 5 feet, I was obliged to accept it, as, on making enquiries, I found that no smaller craft was available.

Notwithstanding my inability to steam about the harbour at all times of tide, I trust a sufficient number of observations were taken to give an approximate idea of the set and velocity (an exaggerated one having, I believe, been previously formed) of the tides in the harbour.

The greatest velocity registered was 3.5 miles per hour at the entrance to the Jumboo creek, whilst 3 miles per hour was registered at several positions about the harbour. I am of opinion, however, that the excessive height of the water in the harbour during the rains is the cause of a diminished velocity of tide in the actual channels, as the banks and mud flats are invariably covered, and the force diminished, by being distributed over a larger area; and that during the dry season, when the water is at a lower level, with the banks and flats uncovered, the same, if not a greater, velocity would be registered.

A limited number of observations were taken in the Bacood creek, on account of the shoal water in the channels; and I believe that if immediate steps are not taken to remove the sand obstruction at its junction with the Mahanaddy river, this creek will be closed to navigation, as the channel leading to it from the harbour is silting up fast. The same action is going on in the creek leading to the light-house, and, as none but the smallest craft can navigate it at any time of tide, no observations were taken there. I may here state that a general silting up of the whole of the channels in the harbour seems to have taken place, as where there formerly existed a clearly-defined channel I found extensive sand-flats, which will in many places uncover during the dry season. I was not able, however, to make actual comparisons, as there is not a bench-mark to refer soundings to.

All the velocities were measured with an ordinary tachometer, which was frequently tested and the rate calculated per statute mile of 5,280 feet therefrom. The set of the tides was found by the usual method, with a wooden flat.

While at False Point, I took the opportunity of fixing positions of the buoys marking the limits of the anchorage and forwarded the angles to the Head-quarters Office, Calcutta; also of taking several measurements at the Spit (Reddie Head) finding on comparison with my survey of April last that the high line has extended considerably to the north and north-west.

A malignant type of fever was prevalent during my stay at Huki Tola, and all the residents suffered considerably. A week after arrival our men showed signs of having it, and I was eventually obliged to send the Sookanie to Calcutta, as he was on the point of dying.

The party returned to Calcutta by the S S. *Madura* on the 16th September.

List of Charts, &c., issued at the Marine Survey Department from April, 1875, the date on which work was commenced at Head-Quarters, to 30th September, 1881.

INDIAN OCEAN.

- | Office
No. of Chart. | |
|-------------------------|--|
| O. 11. | Indian Ocean: Curves of equal magnetic variation. By R. C. Carrington, F.R.A.S. <i>Price, Annas 8.</i>
Indian Ocean, Suez to Penang, including Zanzibar and Madagascar (Engraved). Physical and track chart. Compiled by R. C. Carrington, 1881. <i>Price, Re. 1.</i> |
| O. 1257. | Arabian Sea, Western portion, with plans of Babel Mandeb Strait and Zanzibar harbour. Compiled from the latest Government Surveys, by R. C. Carrington, F.R.A.S., 1881. <i>Price, Re. 1-8.</i> |
| O. 1257a. | Arabian Sea, Eastern portion, with plans of Kurrachee, Bombay, Colombo, Galle, and Madras. Compiled from the latest Government Surveys, by R. C. Carrington, F.R.A.S., 1881. <i>Price, Re. 1-8.</i> |

INDIA—WEST COAST.

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|----------|--|
| N. 15. | Kurrachee to Vingorla. Compiled from the latest Government Surveys, by R. C. Carrington, F. R. A. S., 1876. <i>Price, Re. 1-12.</i> |
| N. 15a. | Vingorla to Cape Comorin. Compiled from the latest Government Surveys, by R. C. Carrington, F. R. A. S., 1876. <i>Price, Re. 1-12.</i> |
| N. 95. | Port of Sáláya or Seraia. By Commander A. D. Taylor, I.N., 1879. <i>Price Re. 1.</i> |
| N. 1217. | Cutch Mándvi. By Commander A. D. Taylor, I.N., corrected to 1879. <i>Price, Re. 1.</i> |
| N. 27. | Veráwal Roads. By Lieutenants Constable and Stiffe, I.N., 1853, corrected to 1878. <i>Price, Re. 1.</i> |
| M. 39. | Sketch of the Entrance to Rajpuri River. By Navigating Lieutenant W. P. Haynes, R.N., 1876. <i>Price, Annas 8.</i> |
| M. 1190. | Ratnagiri, including Mirya and Kalbadavie Bays. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1878. <i>Price Re. 1.</i> |
| M. 1231. | Kundari Island to Chaul. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1879. <i>Price, Re. 1.</i> |
| M. 1232. | Chaul and Entrance to Kundalika River. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1879. <i>Price Re. 1.</i> |
| M. 1191. | Rajpur Bay and Viziadurg, with adjacent Coast. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1879. <i>Price, Re. 1.</i> |
| M. 1233. | Jaygad and Entrance to Shastri River. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1879. <i>Price, Re. 1.</i> |
| M. 1234. | Dabhol and Entrance to Washishti River. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1879. <i>Price, Re. 1.</i> |
| M. 1252. | Bankot and Entrance to Savitri River. By Navigating Lieutenant E. W. Petley, R.N., 1880. |
| M. 43. | Goa and Marmagao Roadsteads. By Commander A. D. Taylor, I.N., 1877. <i>Price, Annas 12.</i> |
| K. 63. | Sadashivgad Bay, including the port of Kárwar and Beitkul Cove. By Navigating Lieutenant E. W. Petley, R.N., 1880. |
| L. 1176. | Narakel Anchorage. Compiled from the latest Government Surveys, 1878. <i>Price Annas 8.</i> |
| I. 851. | Quilon Roads. By Lieutenant A. D. Taylor, I.N., 1858. <i>Price Annas 8.</i> |
| K. 61. | Lakadivh Group—Cherbaniani Reef, Chitlac and Kiltan Islands. By Lieutenants Selby and Taylor, I.N., 1848. <i>Price Annas 12.</i> |
| L. 53. | Byramgore Reef or Chereapani, and Angria Bank. By Lieutenants Selby and Taylor, I.N., 1848. <i>Price, Annas 8.</i> |
| J. 81. | Kolachel Roadstead, with plan of Enciam Rocks. Surveyed by M. Chapman, I.N., 1875. <i>Price Re. 1-8.</i> |

EAST COAST OF INDIA—BAY OF BENGAL, CEYLON, &c.

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|----------|---|
| N. 15b. | Cape Comorin to Cocanada, including the island of Ceylon. Compiled from the latest Government Surveys, by R. C. Carrington, F.R.A.S., 1876. <i>Price, Re. 1-12.</i> |
| M. 1218. | Tuticorin Roadstead and Harbour. Surveyed by M. Chapman, I.N., 1879., <i>Price, Re. 1.</i> |
| G. 93. | Approaches to Jafnapatam. Compiled from the latest Government Surveys, 1878. <i>Price, Re. 1.</i> |

- Office
No. of Chart.
- G. 95. Paumben Pass. Surveyed by M. Chapman, I.N., 1878. *Price, Re. 1.*
- G. 1184. Approaches to Paumben Pass. Surveyed by M. Chapman, I.N., 1878. *Price, Re. 1.*
- G. 1235. Mullaittivu or Moeletivo. By J. Donnan, 1879. *Price, Annas 8.*
- G. 1256. Batticaloa Roadstead. By Mr. O'Dowd, Surveyor General's Department, Ceylon, 1881. *Price Annas 8.*
- G. 1175. Colombo Harbour and its approaches. Compiled from the latest Government Surveys, 1878. *Price, Re. 1.*
- G. 1171. Approaches to Point de Galle Harbour, Ceylon. By T. H. Twynam and Commander A. D. Taylor, 1877. *Price, Re. 1.*
- F. 103a. Bay of Bengal, Western Sheet. Compiled from the latest Government Surveys, by R. C. Carrington, F.R.A.S., 1879. *Price, Re. 2.*
- F. 103b. Bay of Bengal, Eastern Sheet. Compiled from the latest Government Surveys, by R. C. Carrington, F.R.A.S., 1879. *Price, Re. 2.*
- F. 104. Coromandel Coast. Sheet No. 2, from Latitude 15° to 16° 30' N. *Price, Re. 1.*
- F. 104. Sheet No. 3, from Latitude 13° to 15° N. *Price, Re. 1.*
- F. 104. Sheet No. 4, Lieutenant M. A. Sweny, I.N., 1859-60. *Price, Re. 1.*
- F. 105. Madras Roadstead. Surveyed by Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1876. *Price, Re. 1.*
- F. 1172. Orissa Coast, Narsapur Point to Palmyras Point, adapted to the latest determinations of the G. T. S., and observations by Commander A. D. Taylor, I.N. Compiled by R. C. Carrington, F.R.A.S., corrected to 1880. *Price, Re. 1.*
- N. 15c. Cocanada to Bassein River. Compiled from the latest Government Surveys, by R. C. Carrington, F.R.A.S., 1876. *Price, Re. 1-12.*
- F. 113. Coringa or Cocanada Bay showing the Northern Godavery Mouths. By Navigating Lieutenant G. C. Hammond, R.N., 1875. *Price, Re. 1-8.*
- F. 1165. False Point Harbour and approaches. By Navigating Lieutenant G. C. Hammond, R.N., 1876, corrected to 1880 by Commander A. D. Taylor, I.N. *Price, Re. 1.*
- E. 117. Hooghly River.—Luff Point to Anchoring Creek, showing the James and Mary Shoals and entrance to the Roopnarain River. By Navigating Lieutenant Coghlan, R.N., 1875. *Price, Re. 1-8.*
- E. 115. False Point to Mutlah River, showing the approaches to Sandheads. From the latest Government Surveys. Compiled by R. C. Carrington, F.R.A.S., corrected to 1881. *Price, Re. 1.*
- E. 115a. Mutlah River to the Chittagong Coast. Compiled from the latest Government Surveys, 1879. *Price, Re. 1.*
- D. 126. Chittagong or Kornafuli River. Surveyed by Lieutenant G. C. Hammond, R.N., 1876. *Price, Re. 1.*

COAST OF BURMA, &c.

- N. 15d. Bassein River to Pulo Penang, including the Andaman and Nicobar Islands. Compiled from the latest Government Surveys by R. C. Carrington, F.R.A.S., 1876. *Price, Re. 1-12.*
- C. 184. Coronge Island to White Point, including the Gulf of Martaban. Compiled from the latest Government Surveys, by R. C. Carrington, F.R.A.S., corrected to 1878. *Price, Re. 1.*
- C. 137. Preparis North Channel and Entrance to Bassein River. By Commander A. D. Taylor, I.N., and latest Government Charts. Compiled by R. C. Carrington, F.R.A.S., 1879. *Price, Re. 1.*
- C. 143. Rangoon River Approaches. Surveyed by Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1876. *Price, Re. 1.*
- C. 144. Port of Rangoon in eight sheets. By Lieutenant W. H. Coombs, R.N., 1881. *Price, Re. 5.*
- C. 145. Entrance to Salween (Maulmain) River. Surveyed by Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1877. *Price, Re. 1.*
- C. 146. Port of Maulmain. By W. Maurice Bean, I.M., 1880. *Price, Re. 1.*
- B. 151. Coast of Tenasserim—Tavoy River, from a sketch by Lieutenant R. Moresby, with Corrections and Additions, by Commander A. D. Taylor, I.N., 1876. *Price, Re. 1.*
- A. 161. Stewart's Sound. By Mr. D. Paget-Jones, Commanding I. G. S. *Kwantung*, 1881. *Price, Re. 1.*
- A. 171. Port Mouat, Andamans. Surveyed by F. W. Allen, Commanding I. G. S. *Constance*, 1880.

SIAM—MALAY PENINSULA, WEST COAST.

- B. 1173. Hayes Island to the Pilgrims. Surveyed by Commander A. deRichelieu, Siamese Navy, 1877. *Price, Re. 1.*

- Office
No. of Chart.
- B. 159. Kopah Inlet, from a Sketch by Commander A. D. Taylor, I.N., 1876. *Price, Rs. 1.*
- B. 1164. Salang Island (Junkseylon). Commander A. deRichelieu, Siamese Navy, 1876. *Price, Rs. 1.*
- B. 1163. Junkseylon, East Coast—Puket or Tonkah Harbour. By Commander A. deRichelieu, Siamese Navy, 1876. *Price, Rs. 1.*

GULF OF SIAM.

- ZZe 1177. Siam Gulf, West Coast, Hilly Cape to Lacon Bight. Surveyed by Captain A. J. Loftus, Siamese Navy, 1872. *Price, Rs. 1.*
- ZZe 1179. Siam Gulf, West Coast, Lacon Bight to Lem Chang P'ra. Surveyed by Captain A. J. Loftus, Siamese Navy, 1872. *Price, Rs. 1.*
- ZZe 1174. Patani Bay. Surveyed by Captain A. J. Loftus, Siamese Navy, 1872. *Price, Annas 8.*
- ZZe 1178. Singora Roadstead and Inner Harbour. Surveyed by Captain A. J. Loftus, Siamese Navy, 1872. *Price, Rs. 1.*
- ZZe 1180. Lacon Roads. Surveyed by Captain A. J. Loftus, Siamese Navy, 1871-72. *Price, Rs. 1.*
- ZZe 1181. Samuie Strait. Surveyed by Captain A. J. Loftus, Siamese Navy, 1871-72. *Price, Rs. 1.*
- ZZe 1182. Langsuen Roads. Surveyed by Captain A. J. Loftus, Siamese Navy, 1871-72. *Price, Rs. 1.*

SAILING DIRECTIONS, &c.

- ¹ The Sailing Directory, Part I, India, Africa and South America with Charts by Commander A. D. Taylor, I.N., F.R.G.S., SuperRoyal 8vo., cloth, lettered. *Price, Rs. 16; packing and postage Rs. 1-12.*
- Return of Wrecks and Casualties in Indian Waters for the year 1876, together with a Chart showing the positions in which they occurred. Prepared by R. C. Carrington, F.R.A.S., F.R.S.L., Registrar of Wrecks. *Price, Rs. 2.*
- Ditto ditto for 1877. *Price, Rs. 2.*
- Ditto ditto for 1878. *Price, Rs. 2.*
- Ditto ditto for 1879. *Price, Rs. 2.*
- Ditto ditto for 1880. *Price, Rs. 2.*
- List of Light-houses and Light-vessels in British India (Suez to Singapore), corrected from official information. By R. C. Carrington, F.R.A.S., 1881. *Price, Rs. 1.*
- Spheroidal Tables, for every ten minutes of the quadrant, showing the length in feet of a degree, minute, and second of latitude and longitude; the corresponding number of statute miles in each degree of latitude; the number of minutes of latitude, or nautic miles contained in a degree of longitude, under each parallel of latitude, and the length, in cables, of a minute of longitude, corresponding to each nautic mile. Compression $\frac{1}{334}$. By R. C. Carrington, F.R.A.S., 1877. *Price, Rs. 1.*
- Glossary of French Terms adopted on French Charts and maps and in sailing directions. By R. C. Carrington, F.R.A.S., Marine Survey of India, 1879. *Price, Annas 12.*
- Table of Natural Scales, 1877. *Price, Annas 4.*
- Catalogue of Charts, Maps, Plans, &c., in the Marine Survey Department, Calcutta. Compiled by R. C. Carrington, Marine Survey of India, 1879. *Price, Annas 8.*
- Catalogue of Original and other documents deposited in the Marine Survey Department, 1881. *Not for sale.*

HYDROGRAPHIC NOTICES.

Price, four annas each.

No.

1. Rangoon River. By Navigating Lieutenant F. W. Jarrad, R.N., 1876.
2. Cancelled; superseded by Notice No. 8.
3. Cancelled; superseded by Notice No. 18.
4. Cancelled; superseded by Notice No. 23.
5. Kyouk Phyou Harbour. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1877.
6. Salween (Maulmain) River. By Navigating Lieutenant F. W. Jarrad, R.N. F.R.A.S., 1877.
7. Approaches to Point de Galle Harbour. By Commander A. D. Taylor, I.N., 1877.
8. Mergui Archipelago. Pages 7 to 10 of this Notice superseded by Notice No. 18.

¹ Published by Messrs. Allen and Company, Pall Mall, London.

P rice, four annas each.

No.

9. Indus Banks and Kurrachee. By Lieutenant A. W. Stiffe, I.N., and the Master Attendant of Kurrachee, 1877.
10. Pámban (Paumben) Pass. By Morris Chapman, I.N., 1878.
11. Andaman Islands. By Navigating Lieutenant J. Tully, R.N., 1878.
12. Jiddah Harbour, Red Sea. By Commander W. J. L. Wharton, R.N., H. M.'s Ship *Fawn*, 1878.
13. Red Sea. Navigation, Inshore passages, 1878.
14. Red Sea. 1878.
15. South Indian Ocean, Seychelle, Farquhar Islands, and Madagascar. By Commander W. J. L. Wharton, R.N., H. M.'s Ships *Shearwater* and *Fawn*, 1875-78.
16. Torres Strait and New Guinea, South-East Coast. By Officers of H. M.'s Ships employed on the Australian Station, 1878.
17. India, West Coast, Ratnagiri, Rajapur Bay and Viziadurg. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1878.
18. Coast of Siam, including Junkseylon and adjacent islands. By Commanders A. D. Taylor, I.N., and A. de Richelieu, Siamese Navy, 1879.
19. Africa, East Coast, Pemba Island and Adjacent coast. By Commander W. J. L. Wharton, R.N., H. M.'s Surveying Vessel *Fawn*, 1878.
20. India, West Coast, the coast from Kundari Island to Chaul, and the harbours of Dabhol and Jaygad. By Navigating Lieutenant F. W. Jarrad, R.N., F.R.A.S., 1880.
21. Arabian Coast, Rás Matbakh, 1880.
22. Red Sea. Notes from various sources, 1880.
23. Coast of Orissa. False Point Harbour and approaches. By Navigating Lieutenant G. C. Hammond, R.N., and Commander A. D. Taylor, I.N., 1880.
24. India, West Coast, Harbours of Kárwar and Bankot. Compiled from notes by Navigating Lieutenant E. W. Petley, R.N., and remarks by Commander A. D. Taylor, late I.N., 1880.

NOTICES TO MARINERS.

Notices to Mariners issued during the year 1875. *Price, one anna each :—*

- No. 1. Fixed Light on Green Island, Hong Kong, China.
- " 2. Malwan Rock, Malwan.
- " 3. Fixed white Light at Dwarka, Kattywar.
- " 4. Mooram Shulli Tivo Island, and Devil's Point Gulf of Mansar.
- " 5. (1) Fixed light at Vizagapatam.
(2) Coral shoal off Caltura, Ceylon.
(3) Rock off Barbery Island.
- " 6. Foundering of the Buoy Vessel *Mata Mata*, Rangoon.
- " 7. (1) Revolving Light near Acheen Head, Malacca Strait.
(2) Auxiliary Light to above.

Notices to Mariners issued during the year 1876. *Price, one anna each :—*

- No. 1. Temporary discontinuance of Hope Island Light during repairs to Light-house column, Coromandel Coast.
- " 2. Exhibition of Hope Island Light, Coromandel Coast.
- " 3. Prohibited anchorage near the British Indian Sub-marine Telegraph Cable, Madras.
- " 4. (1) Pulo Brasse auxiliary Light, Malacca Strait.
(2) Island between Pulo Nias and Sumatra.
- " 5. Vessels trading to Réunion, Indian Ocean.
- " 6. Replacement of the Buoy on the western edge of Dolphin Shoal, Chittagong Coast.
- " 7. China Bakeer Light, Martaban Gulf.
(2) Intended exhibition of Light on the Oyster Reef, Akyab.
- " 8. Fixed white light at Veráwal.
- " 9. Buoyage of Kyouk Phyou, British Burma.
- " 10. Fixed white Light at Bet or Beyt (Gulf of Cutch), Kattywar.
- " 11. Fixed white Light at Porbandar, Kattywar.
- " 12. (1) Displacement of the Buoy in Narakel Roadstead, Cochin.
(2) Buoy marking the smooth-water anchorage to the southward of Alipee (Aulapolay), Travancore.
- " 13. (1) Intended Light on Pulo Pisang, Malacca Strait.
(2) Sunken reef in Siberoet Strait, Sumatra, West Coast.
- " 14. Deposit of stone mound at the end of the breakwater, Colombo, Ceylon.
- " 15. Period of exhibition of the *blue* Light during the South-West monsoon, from the Eastern Channel Light-vessel at the entrance to River Hooghly.
- " 16. Rock near west end of Pulo Brasse.
- " 17. (1) Beacon on two-fathom patch off Batticaloa Road, Ceylon.
(2) Suspension of Light at Vizagapatam.
- " 18. Directions for Kurrachee Harbour.
- " 19. Beacon on two-fathom patch off Batticaloa Road, Ceylon.
- " 20. Fixed light at Callingapatam Point, Coromandel Coast.

Notices to Mariners issued during the year 1877. *Price, one anna each :—*

- No. 1. Alteration in Manora Point Light, Kurrachee.
- " 2. Dangers at Goa and Marmagao Roadstead.
- " 3. Existence of rocky patches, Beypore.
- " 4. Pooree Port limits, Orissa Coast.
- " 5. Extension of the Hajamri Mouth of the River Indus.

- No. 6. Red Lights at Port Victoria, Mahé, Seychelles.
- „ 7. Light at Port Berberah, Gulf of Aden.
- „ 8. Rock off Hingie Island, Bassein River.
- „ 9. Rock off Pegu Coast.
- „ 10. Coral Patch near Sultan Shoal, Singapore Strait.
- „ 11. "Intermediate" Light-ship, entrance to River Hooghly.
- „ 12. Position of Cochin Light-house.
- „ 13. Position of Raleigh Rock, and additional beacons, Bombay.
- „ 14. Buoy, marking Gindurah Rock, Galle.
- „ 15. Alteration in Manora Point light, Kurrachee; and discovery of a bank near Towak Island, Red Sea.
- „ 16. Dangerous rocks in Forrest Strait, Mergui Archipelago, and Richelieu Rock off Kopah Inlet.
- „ 17. Alteration in position of "Intermediate" Light-ship, entrance to River Hooghly.
- „ 18. Destruction of the Krishna Shoal Light-house.
- „ 19. Correct position of Santipilly Light-house.
- „ 20. Anchorage Buoys in Madras Roadstead.
- „ 21. Light-vessel near Krishna Shoal, Burma.
- „ 22. Additional information, Krishna Shoal Light-vessel and Light at Pooree.
- „ 23. Alteration of position of Chittagong Lights.
- „ 24. Night Signals shown by British Pilot Vessels in the English Channel.

Notices to Mariners issued during the year 1878. *Price, one anna each* :—

- No. 1. Position of Middle Ground, Bombay.
- „ 2. Error in position of Krishna Shoal Light-vessel.
- „ 3. New Lights in Sunda Strait, &c.
- „ 4. Corrected position of Krishna Shoal Light-vessel.
- „ 5. Alteration of colour of Chittagong beacons, and intended alteration in Dolphin Rock Light, Bombay.
- No. 6. Alteration of Malwan Light.
- „ 7. Kintoan Light-vessel, Yang-tse-Kiang.
- „ 8. Burgees Rock off Hingie Island, Bassein River, Burma.
- „ 9. Fairway Buoy at False Point, Orissa.
- „ 10. (1) Intended Light and fog signal on Little Basses Rocks, Ceylon.
(2) Intended alteration in Great Basses Rocks Fog Signal.
- „ 11. Corrected positions of Zebuyir Islands, Jebel Zukur and the Hânish Islands, Red Sea.
- „ 12. Fog signals and distinguishing marks for Light-vessels, River Hooghly.
- „ 13. Exhibition of Light on Little Basses Rocks, Ceylon.
- „ 14. Beacon on Chau Kadu Rock, Bombay.
- „ 15. Shoal near Tumb Island (Jazirat Tamb), Persian Gulf.
- „ 16. Light at Batticaloa, Ceylon.
- „ 17. Upper Gasper Light vessel, entrance to River Hooghly.
- „ 18. Red Groyne on North Groyne of Harbour Works, Madras.
- „ 19. Reported shoal, N. N. E. of Bahrein, Persian Gulf.
- „ 20. Alteration of colour of light at Klang Strait, Strait of Malacca.
- „ 21. Additional information concerning the reported shoal, N. N. E. of Bahrein.
- „ 22. Deposit of stone, eastward of Harbour Works, Madras.
- „ 23. Reported Shoal, North-West of Cheduba Island.
- „ 24. Exhibition of blue lights and maroons at Krishna Shoal Light-vessel.
- „ 25. Deposit of stone, eastward of Harbour Works, Madras (additional information).
- „ 26. Vessels prohibited from anchoring near the Sub-marine Telegraph Cable between Diamond Island and the mainland.
- „ 27. Intended exhibition of a revolving Light at Vakalapudi, in the Godavery District.

Notices to Mariners issued during the year 1879. *Price, one anna each* :—

- No. 1. Permanent moorings for Eastern Channel Light-vessel, entrance to Hooghly River.
- „ 2. Sunken danger in Mergui Archipelago.
- „ 3. Revolving Light at Vakalapudi, in the Godavery District.
- „ 4. Intended alteration in False Point Light.
- „ 5. Shifting of the entrances to Honore (Honawar) and Mangalore, on the Malabar coast.
- „ 6. Fixed Light at Roji (Nowa Nugga) in the Gulf of Cutch.
- „ 7. Fixed Light at the entrance to Toona Creek in the Gulf of Cutch.
- „ 8. Fixed Light at Goapnath Point in the Gulf of Cambay.
- „ 9. Wreck-marking vessels.
- „ 10. The alteration in the position and improvement of Pooree Port Light.
- „ 11. Shoal coral ground in Strait of Banks.
- „ 12. Delagoa Bay. Removal of Cockburn Light-vessel in bad weather.
- „ 13. (1) Alteration in position of Beacons and Leading Lights—Burnett River Entrance, Australia.
(2) Fixed Light on Flat-top Islet—Pioneer River—Rocky Islets.
(3) Revolving Light on Low Isles—Trinity Bay.
(4) Leading Lights at Cook Town—Endeavour River Entrance—Cook Harbour.
- „ 14. Sunken dangers between Alguada Reefs and Diamond Island—Bay of Bengal.
- „ 15. Flashing white light on Puysegur Point—New Zealand.
- „ 16. Dangerous rocks, N. N. W. and S. E. of the southernmost of the Brothers Islands—Andaman Islands.
- „ 17. Australia—South Coast—Gulf of St. Vincent.
(1) Prohibited anchorage near Telegraph Cable, Port Phillip.
(2) Buoys marking battery practice range at Williams Town.
(3) Fixed and Flashing Light on North Reef.
- „ 18. Longitude of the Time Ball, Calcutta, and of Sangor Light-house, River Hooghly.
- „ 19. (1) Discontinuance of additional Light at Fourth Point—Sunda Strait—Java.
(2) Shoal in the Fairway to Batavia Road.
(3) Fixed Light on Meinder's Reef—Madura Strait.
- „ 20. (1) Shoal ground westward of Durnford Point—South Coast of Africa.
(2) Distinguishing features marking the entrance to Tugela River.
(3) Ditto entrance to Umhloti River.
- „ 21. Buoys off Carwar Harbour (Sadashigar).
- „ 22. (1) Alterations in Lights at St. Paul and St. Denis, Réunion Island.
(2) Harbour Light at St. Pierre.
- „ 23. Buoys off Carwar Harbour (Sadashigar).

- No. 24. Buoys and Beacons, Zanzibar Harbour.
 „ 25. Alteration of False Point Light—Coast of Orissa.
 „ 26. Red Buoy marking smooth-water anchorage off Porcaud, Alleppey.
 „ 27. Change in the Anchorage Limits of the Port of Madras.
 „ 28. Intended discontinuance of Light at El-weg (Sherm Wej-b), Red Sea.
 „ 29. Interval of intended exhibition of blue lights and rockets at False Point Light-house.
 „ 30. Replacing of the buoys at the entrance to Cochin Harbour, and extinguishing of Narrakel Light.
 „ 31. Range of visibility of the Light exhibited from Krishna Shoal Light-vessel.
 „ 32. Light at Batticaloa.
 „ 33. Black buoys laid down in Calicut Roadstead to mark the limits of foul ground.
 „ 34. Light at Batticaloa.
 „ 35. Replacing of the buoys off Carwar Harbour (Sedashigar).
 „ 36. Telegraph buoy, south of Aden.
 „ 37. Black buoy off Point Gordeware (Godavery).
 „ 38. Light at Batticaloa.
 „ 39. Exhibition of a leading Light in Suez Bay.
 „ 40. Madras Semaphore.
 „ 41. Black buoy off Point Gordeware (Godavery).
 „ 42. Madras Semaphore.
 „ 43. Buoys at Calicut.

Notices to Mariners issued during the year 1880. *Price, one anna each :*

- No. 1. Prohibited anchorage near the telegraph cables in Zanzibar Harbour.
 „ 2. Discontinuance of maroon Lights at Krishna Shoal Light-vessel.
 „ 3. Exhibition of the new fixed Light at False Point.
 „ 4. Extension of the period of exhibition of the “ Intermediate ” Light at the entrance to the Hoogly River.
 „ 5. Alterations in the position and visibility of the Light exhibited from Port Canning, Singapore.
 „ 6. Alteration of position and elevation of the red Light at Cannanore.
 „ 7. Discontinuance of the exhibition of maroons from the Light-vessels of the Hooghly River.
 „ 8. Fixed light at Tolleshwar, Dabhol or Anjanvel.
 „ 9. Lights at Port Ibrahim, Suez.
 „ 10. Changes in the buoyage of the port, Madras.
 „ 11. Intended alteration of Kenery (Kundari) Island Light.
 „ 12. Flashing Light on Flat Cape, Sunda Strait.
 „ 13. Destruction of First Point Light-house, Java.
 „ 14. Harbour Light at Beliling, Baly Island.
 „ 15. Position of Gwalia reef, Carimata Strait.
 „ 16. Position of Parkin rock, Haniish Islands, Red Sea.
 „ 17. Shoal south-west of Barren Islands, west coast of Madagascar.
 „ 18. Intended alteration in Light apparatus at Calicut.
 „ 19. Lights at Port Ibrahim, Suez, (additional information).
 „ 20. Intermittent flashing Light on Pulo Undan, Malacca Strait.

Notices to Mariners issued during the year 1881 (to 30th September). *Price, one anna each.*

- No. 1. Light regulations for Pilot brigs, River Hoogly.
 „ 2. Rules for regulating the entry and departure of vessels using Madras Harbour.
 „ 3. Re-exhibition of light on First Point, Java.
 „ 4. Light at Tagal, Java.
 „ 5. Beacon on Borongo island, Akyab.
 „ 6. Discontinuance of Armeghon light and intended change of colour of Pulicat light.
 „ 7. Tidal semaphore at entrance to Chittagong river.
 „ 8. Alteration of colour of light at Ratnagiri.
 „ 9. Red light on Colombo breakwater.
 „ 10. Red buoy off Godavery Point, Cocanada.
 „ 11. Alterations to Lights at Paumben and Tellicherry.
 „ 12. Particulars of Light at First Point, Java.
 „ 13. Alteration in character of Light at Flat Cape, Sumatra.
 „ 14. Removal of north buoy, Madras Harbour.
 „ 15. Range of visibility of the Light at Paumben.
 „ 16. Beacons for clearing the south-west Prong, Bombay Harbour.
 „ 17. Lights at Zanzibar.
 „ 18. Gas buoy at entrance to Port Said, Suez Canal.
 „ 19. Revolving Light at Armeghon.
 „ 20. Beacon on Tucker's patch, Bombay Harbour.
 „ 21. Fixed Light at Pulicat.
 „ 22. Fixed Light at Ratnagiri.
 „ 23. Occasional observation of light at False Point.
 „ 24. Breaking adrift of Karwar rock buoy, Karwar or Sadashivgad.
 „ 25. Date of exhibition of permanent white Light at Calicut.
 „ 26. Alteration of colour of Katubdea Light-house, Chittagong Coast.
 „ 27. Exhibition of red and green Lights at Pondicherry.
 „ 28. New beacon on Kal-ah-kebirah Shoal, Gulf of Suez.
 „ 29. Reported coral reef off Batticaloa.
 „ 30. Revised rules for vessels using Madras Harbour.
 „ 31. Wreck buoy to mark wreck of Mariana, Madras Coast.

* * * *The above rates are exclusive of mounting, colouring, packing, and postage.*

Statement shewing the cost of the Marine Survey Department from 1st October, 1880
to 30th September, 1881, inclusive.

PARTICULARS.	Amount of each item.			Total of each heading.		
	Rs.	As.	P.	Rs.	As.	P.
OFFICE OF SUPERINTENDENT OF MARINE SURVEYS.						
Superintendent of Marine Surveys	* 21,600	0	0			
Superintendent, Compiling and Drawing Branch	12,600	0	0			
Office of the Superintendent of Marine Surveys	11,377	0	0			
Contingencies	3,594	0	0			
Travelling allowances	561	0	0			
House-rent paid to Superintendent, Compiling and Drawing Branch	1,133	0	0			
				50,865	0	0
SCIENTIFIC OFFICERS.						
Pay	27,614	0	0			
House-rent, field and conveyance allowance, travelling and halting allowance	10,157	0	0			
				37,771	0	0
I. G. S. "INVESTIGATOR."						
Miscellaneous	77	0	0			
				77	0	0
SURVEY PARTY NO. 1 (WEST COAST OF INDIA.)						
Pay	8,319	0	0			
Provisions	1,634	0	0			
Coal	404	0	0			
Stores	883	0	0			
Repairs	1,281	0	0			
Miscellaneous	4,612	0	0			
				17,133	0	0
SURVEY PARTY NO. 2 (BRITISH BURMA.)						
Pay	2,155	0	0			
Provisions	688	0	0			
Stores	6	0	0			
Repairs	1,365	0	0			
Miscellaneous	1,011	0	0			
				5,225	0	0
MISCELLANEOUS.						
Part construction of the I. G. Surveying Steamer "Investigator"	83,536	0	0			
				83,536	0	0
TOTAL RUPRES . . . . .	.....			1,94,607	0	0

The above statement was received from the Examiner of Marine Accounts, Calcutta.

* Of this sum Rs. 1,453-11-3 were deducted by the Government of India on account of my Indian Naval Pension.

A. D. TAYLOR,
Superintendent of Marine Surveys.







